NOVEMBER, 1953

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APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER TRANSMISSION

INCLUDING AIR CONTROLS AND AIR CIRCUIT DESIGN; ELECTRICAL CONTROLS

AIR POWER SOLVES ASSEMBLY PROBLEM 63

VALVES FOR HEAVY PRESSES 71

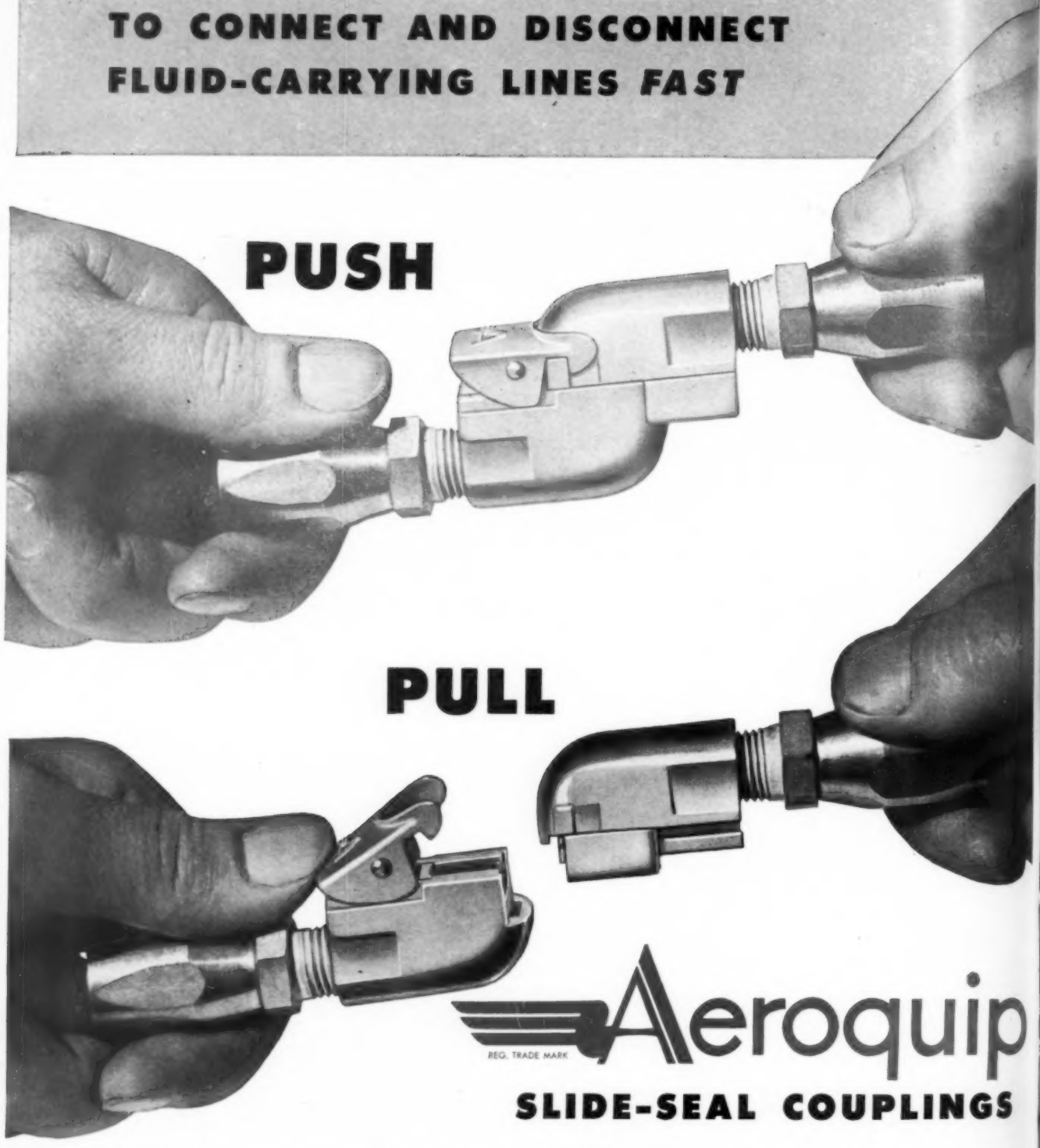
TRACER CIRCUIT FOR CAM MILLING 74

FLOW MEASURING INSTRUMENTS 77

4000 PSI AIRCRAFT CIRCUIT 92

Listed on page 2 you'll find 13 articles and 7 regular departments which feature application and design ideas for fluid power equipment

TO CONNECT AND DISCONNECT FLUID-CARRYING LINES *FAST*



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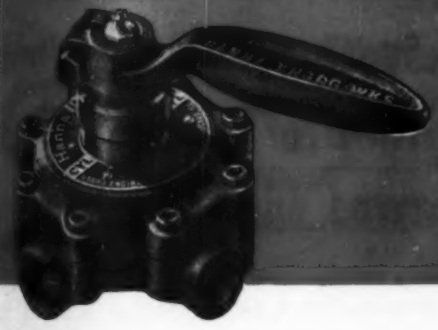

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Circle 47 on Reader Service Card

NOVEMBER, 1953
Vol. 6, No. 11

APPLIED HYDRAULICS

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Circle 79 on Reader Service Card

Electronic spacer patterns guide stockpile through sequence of cuts automatically. Responsive Oilgear Transmission provides speedy travel with pin-point stopping within 3/1000ths of an inch from zero tolerance. Lawson Cutter also used in repetitive single cuts and for trim on sides. Photo in plant of Liedtke Brothers, Chicago.

The RESULT?

Accuracy just 900% better

Production increase 50 to 500%

ver and over and over again, ilgear Fluid Power proves to be e right solution to a drive problem. ake the case of the Lawson Cutter.

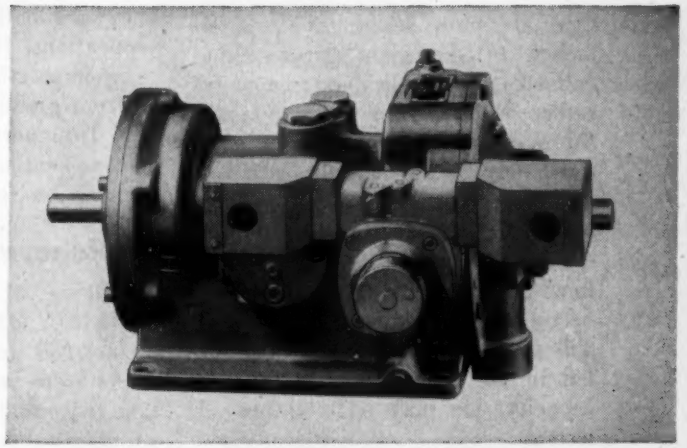
precision is emphasized anywhere, that "where" is field of fine color printing of every description. oney, time, effort are spent that art be right, that plates right, that printing be right—to a hairline. And then mes the cutting operation where all that has gone fore is saved—or wasted. Small wonder that cutting mained a hand operation for many years.

But the E. P. Lawson Company, manufacturer of cut- g machines, wanted to modernize and mechanize the eration. Its designers turned to an electronic spacer vice. This if anything would give precision in mark- g *where* to cut. But the next problem was to find a wer drive capable of *obeying* the orders the elec- nic signal system was capable of *giving*. Lawson ed one type of drive. It varied all over the map. wson tried another type of drive. It was fairly accurate but did not hold up.

Finally, as so many machine designers have done, wson turned to Oilgear. And there, as so many chine designers have done, Lawson found the answer its problem.

The answer? Undeviating accuracy within 3/1000ths an inch from zero tolerance—just 900% better than at had been achieved in the past; speed, translating o production increases of 50% to 500% month in d month out. How? Through the absolute responsive- ss of Oilgear Fluid Power Drive to the automatic ntrol system. Immediate, shockless acceleration to speed "forward". Precise measured slowdown as feed fence nears the target. Precision stopping "on get" for the cut and then rapid acceleration toward next cut.

Here again is an example of the superlative "right-



Oilgear Two way Variable Speed Transmission as used on Lawson Electronic Spacer Cutters. These drives also provide unlimited speed range from zero to maximum. Speed changes made in split second or specified time.

ness" of Oilgear Fluid Power "generators," motors, transmissions—for almost any type of installation or machine requirement, big, little, and all those in between.

Chances are Oilgear is *the* solution you've been looking for. And Oilgear engineers will be just as quick to tell you if Oilgear is *not* for you. Ask for further information from an Oilgear Engineering Representative. No charge. No obligation. THE OILGEAR COMPANY, 1564 W. Pierce St., Milwaukee 4, Wisconsin.

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APPLIED HYDRAULICS

Fluid Power Lines

Could you use 50,000 tons . . .

. . . of forging capacity. In the second of Arthur Greensite's articles on the design of heavy presses, we've included a short summary which tells where the Air Force's press program now stands. We've included some of the reasons for the reduction in the original program of 17 to ten presses. While there are many design problems attached to the giant presses, the cutbacks are largely due to capacity rather than design. Metal fabricators didn't want to take over and finish any of the canceled presses. The government will own all the heavy presses which are to be operated by six fabricators. Roger Lewis, the Air Force's Assistant Secretary for Materiel believes it will take ten years for the presses left in the program to be used to capacity. He may well be proved wrong.

Flow Measurement

What methods are being used to measure flow in hydraulic systems? Harley Kressin answers this question in this third article on instrumentation techniques for hydraulic systems. Design, construction and application of the measuring devices are given.

Air Valves

This month, we resume the Beginner's Course in Basic Pneumatics with the first part of the section on air valves. In several issues, you'll get basic information on the design and construction of available air valves. Poppet and spool types will be discussed along with the many actuating mechanisms.

Using Servomechanisms

In the final article of F. B. MacLaren's series on "Servomechanisms for Industry" several typical industrial applications are described. These precision mechanisms have something in common with the giant forging and extrusion presses. They are both looking for wider applications. High initial cost must be made practical by increased profits from greater and better production. Designers with ingenuity and management with vision can create the uses for these valuable tools.

Honorable Mention

Judging of the papers in the APPLIED HYDRAULICS contest presented one difficult problem. There were seven prizes and more than twice that many papers of prize winning caliber. The judges did a careful job of grading with a point system to evaluate the top seven. To the papers which crowded the top seven, we've awarded Honorable Mention. Two of these papers appear this month. Each shows a practical application of fluid power which helps the user turn out a better product at lower cost.

Motors and Mattresses

While it takes in a lot of territory when we say you can profitably use fluid power in making anything from airplanes to zylophones, we think you'll agree, despite the alphabetic proximity between motors and mattresses, that there's a big difference in products. Two articles this month show that tool designers in plants making electric motors or mattresses have similar problems and can solve them with air powered tooling. Both articles are prize winners in the APPLIED HYDRAULICS Prize Paper Contest. All winners were announced last month.

Applause for NCIH

The Press Session at the National Conference on Industrial Hydraulics meetings in October was a honey. It had an excitement which is not usually found at technical meetings. The speakers had a "hot" subject and did not hesitate to emphasize their opinions. Ably chairmaned by Bob Tabors, the meeting moved rapidly as E. V. Crane and W. R. Jackson of E. W. Bliss discussed "Hydraulic Problems of Large Forging Presses". Now that a 2300 gpm, 3000 psi variable volume, axial piston oil pump has been developed, Mr. Jackson pointed the way to direct powered oil hydraulic systems for giant presses. The oil system would replace present water power accumulator circuits.

In the panel discussion, Dr. M. D. Stone of United Engineering and Mr. Jackson set forth the relative advantages of each system. We came away feeling that after large oil hydraulic, variable volume pumps have proved to give long service at a satisfactory initial cost, the long familiar giant air over water bottles will be a thing of the past.

Next year at the 10th NCIH, papers will be presented on pneumatic as well as hydraulic subjects. Because of this, there'll undoubtedly be a change in the conference name.

Precision Dyna-seal plays vital role in leak-proof operation of this Hydraulic Relief Valve

Dyna-seal®

Synthetic rubber sealing member bonded to steel ring for sealing circular flat surfaces — no grooves necessary!

Rivett Lathe & Grinder, Inc., uses a *Precision Dyna-seal* in order to simplify the construction of this Balanced Piston Hydraulic Relief Valve. Simple to install and maintain, the valve must give long, leak-free service. The *Precision Dyna-seal* plays a vital part in the valve's efficient operation at 1500 P.S.I.

Everyone is finding *Precision Dyna-seals* the simple answer to many sealing problems. *No grooves*—all you need is a flat surface to seal under bolt heads, rivet heads, cap nuts, flanges, special fittings, etc. Suitable for service with petroleum products, water, many other fluids and gases. *Precision* engineers will help you — and proper deliveries will keep your production lines going. Please send us your inquiries now.

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extra high safety factor!

NEW T-J Spacemaker AIR CYLINDERS

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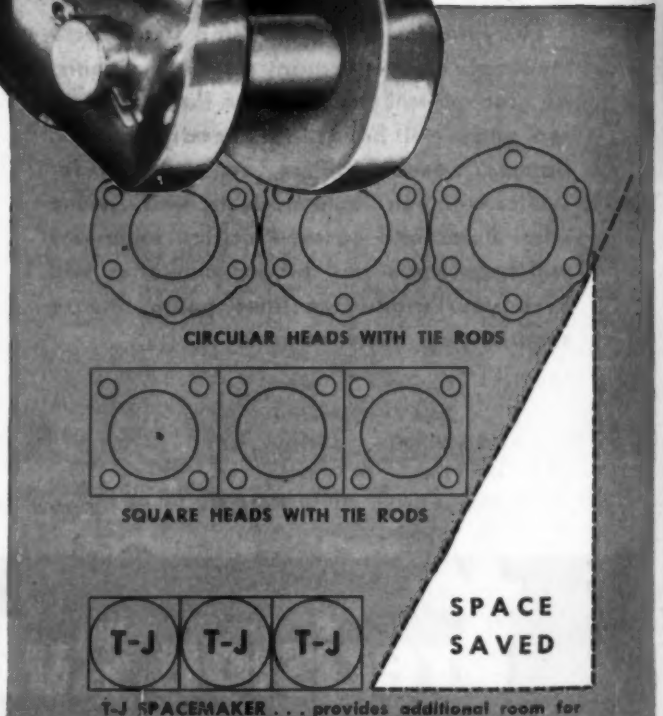
Available with the new T-J Super Cushion Flexible Seals which insure positive cushion with automatic valve action for fast return stroke. Many standard sizes and styles . . . for pushing, pulling, lifting, clamping or control jobs. T-J dependability. Write for bulletin 8152. The Tomkins-Johnson Co., Jackson, Mich.



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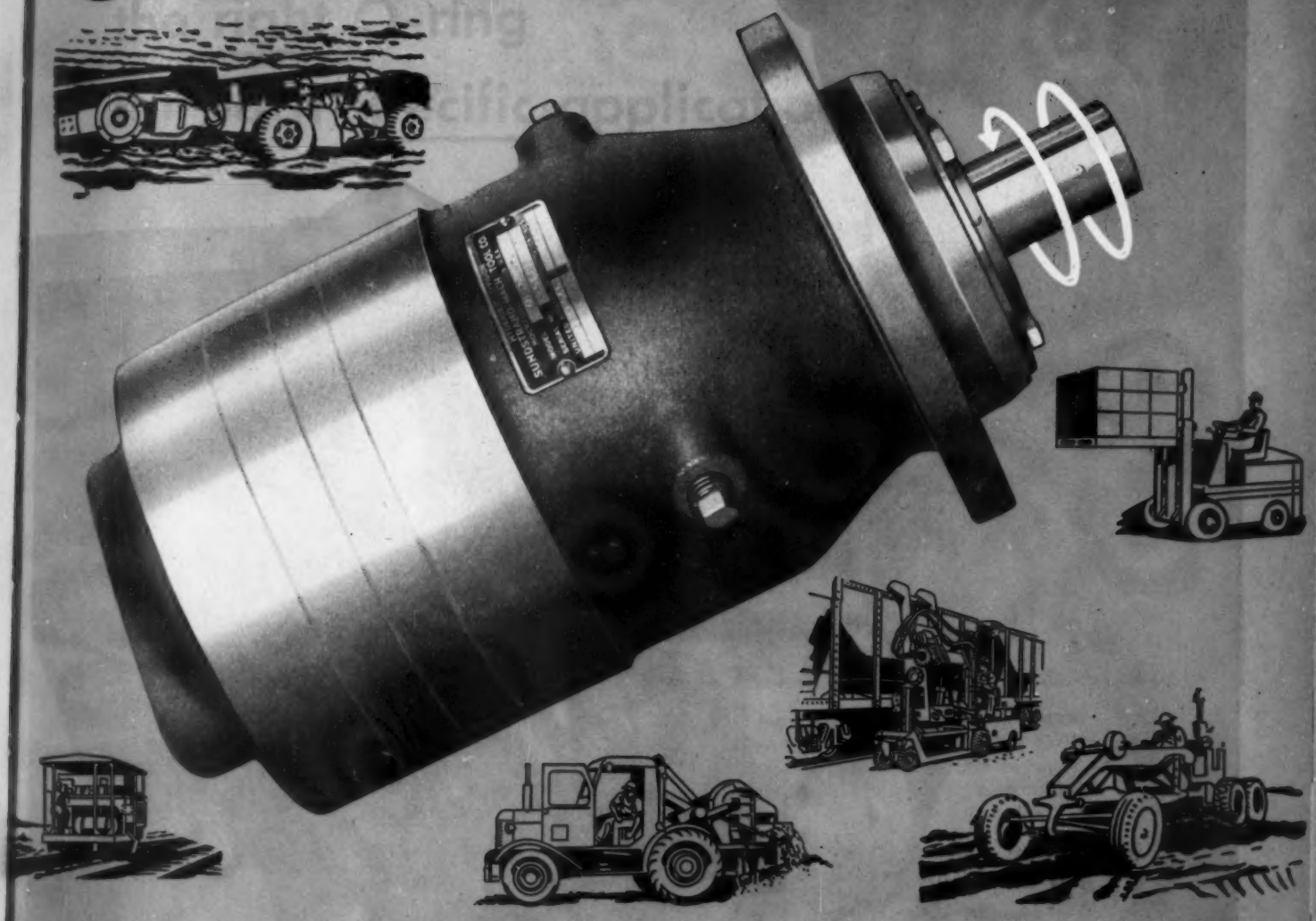

FLUID MOTORS simplify power transmission on mobile units...

Write for this free descriptive booklet
It gives you information on application, operation, performance, models, and mounting arrangements of Sundstrand Fluid Motors. Form No. 113-2.

• Sundstrand Fluid Motors provide driving power by converting pressurized oil to rotary motion through a simple wobbler—piston arrangement. With one of these motors as a source of power, you can eliminate complicated mechanical-type transmissions, which are highly subject to wear and require considerable maintenance. Because the fluid motor is so compact, it can be mounted close to the driven member. This does away with gears, clutches, belts, chains, and long shafting. Windup, which is experienced with mechanical-type drives, is no longer a problem. The driven member receives the full force delivered by the high torque motor. Speeds can be controlled infinitely over the complete range without clutching or changing gears.

Sundstrand Fluid Motors are simple in design . . . built to withstand rugged treatment. The wobbler is the only rotating part. It is dynamically balanced to assure smooth operation and keep maintenance low. Models range in output from 13.65 hp to 30.00 hp at 1000 psi and 1800 rpm. If you have a power transmission problem, a Sundstrand Fluid Motor may be the answer. Write or phone for details.

SUNDSTRAND

SUNDSTRAND HYDRAULICS

SUNDSTRAND MACHINE TOOL CO.

HYDRAULIC DIVISION, ROCKFORD, ILL.

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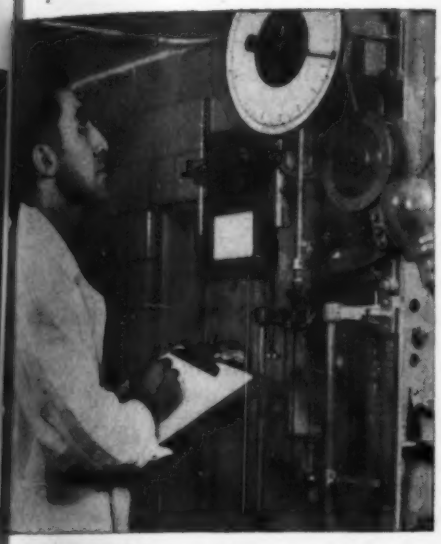
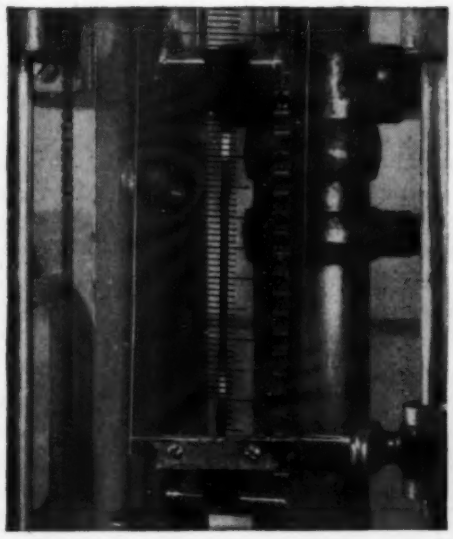
LATHES • MILLING, BROACHING AND SPECIAL MACHINES • BROACHING TOOLS • MAGNETIC CHUCKS

1. Over 800 Parker compounds have been developed to meet your individual O-ring and custom-molded rubber requirements. Just *any* compound won't do the job. Parker checks your specifications to see which compound is best. If none do the job, we'll formulate and mix (shown above) a special compound to solve your individual problem.

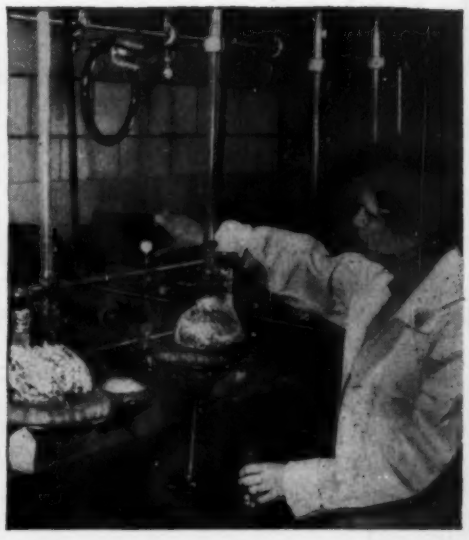
Look how Parker makes sure you get the right O-ring for each specific application



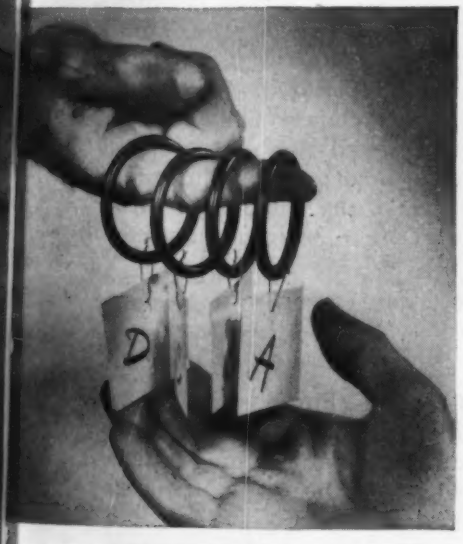
2. Tensile strength is one of the many specifications that each Parker O-ring compound must pass. Other tests prove resistance to both tear and abrasion.



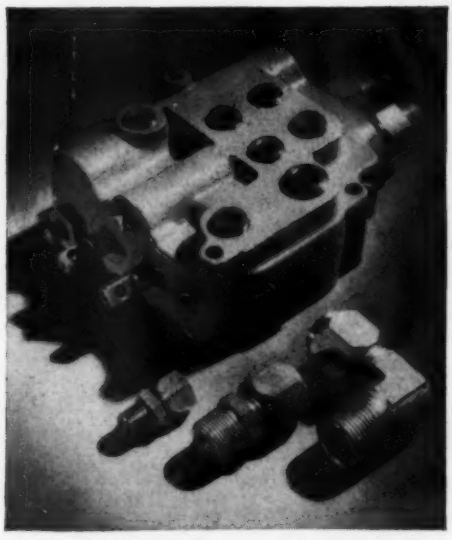
3. Elongation, being tested here, and maximum compression set are other vital factors that determine which compound will assure leakproof O-rings for your application.



4. Fluid and temperature tests help assure long life of Parker O-rings. Compounds are checked for resistance to oil, fuel, or chemicals at high or low temperatures.



5. Prove for yourself that Parker O-rings are right for your specific application. They're economical to use. And they help designers save weight and space!



6. What other Parker products for hydraulic and fluid systems interest you? Triple-lok flare tube fittings? Ferulok flareless fittings? New hydraulic directional control valves?

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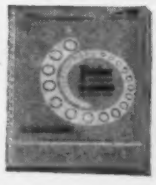

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Hydraulic and fluid system components

USEFUL LITERATURE

You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation

CONTROL VALVES . . . C. B. Hunt & Son, Inc., are offering a 12 page bulletin No. 531, covering air and hydraulic control valves. Several sliding sleeve air valves designed for operation with air at pressures up to 125 psi, are fully described and illustrated. Single plunger valves which are designed for use with air, water or hydraulic oils at pressures up to 250 or 300 psi are also illustrated and described. Sectional views of body, plunger, packing and interior operation are shown. Hydraulic valves with pressures up to 5000 psi are also covered.

Circle 176 on Reader Service Card

HYDRAULIC CYLINDERS AND VALVES . . . A 32 page booklet in color, bulletin No. 22, has been prepared by the Pathon Manufacturing Co., on hydro-mechanical devices. A few of the subjects which this brochure covers are, construction and functional requirements of cylinders, rotating cylinder, mounting brackets, cross-sectional view showing component parts, rams and valves. Complete dimensional drawings for various cylinder bores and pressures are given. Several control valves are illustrated and considerable technical data is given for various models.

Circle 177 on Reader Service Card

FLUID FLOW INSTRUMENTATION . . . The Aero Research Instrument Company has prepared an illustrated bulletin announcing the manufacture of new and improved probes for sensing gas temperature, pressure direction, velocity and turbulance in and about turbo jets, ram jets and some rocket engines. The company is equipped to solve individual probe problems. Aerodynamic performance characteristics can be supplied.

Circle 178 on Reader Service Card

LEATHER SEAL IMPREGNANT . . . A technical report on "Conpor", Chicago Rawhide Manufacturing Company's new synthetic material for the control of porosity, is available. Essentially, the impregnation of chrome retan leathers with oil resistant liquid polymers, followed by further polymerization within the leather, the new material affords "an ideal oil seal and hydraulic packing material that retains all the good properties of leather. It has flexibility, strength, stability, resistance to oils and solvents, is flexible at low temperatures and ages well. It provides a substantial increase in service life". Typical of the company's checks on the leak-proof efficiency of various "Conpor" leathers are the static permeability tests run on discs using an SAE 10 oil at 4 psi; within the same time limits an untreated leather leaked 179 grams of oil, while the new "Conpor" leather leaked only 3.2 grams. Similarly, using flange packings for sealing air pressure, where untreated leathers were able to seal only 3 ounces per square inch; variations in the "Conpor" impregnations produced sealages ranging from 13 psi to no leakage at 100 psi.

Circle 179 on Reader Service Card

AIR VALVES . . . An 8 page folder on air valves and clamps has been released by The A. K. Allen Co. Many types of air valves are illustrated and described, such as two-way, three-way, four-way, cam operated and hand operated. Pilot timer three-way valve, hold down clamp and side clamp are included. A cross sectional view of the three-way and four-way pilot timer valve is illustrated in such a way that each of the component parts are also illustrated and their position shown in the assembly.

Circle 180 on Reader Service Card

BREATHER FILTERS . . . For installations on crankcases of engines and compressors, gear cases, hydraulic equipment, liquid storage tanks and machinery housings, has been covered in an Engineering Data File, Form BC-750, prepared by Air-Maze Corporation. Many models of filters are illustrated. Included is a listing of the stock filters of the "oil-wetted" and of the "oil-bath" type. Dimensional tables are set up for each type showing size of vent, type of base, diameter, overall height and approximate weight. A description of the "oil-wetted" and of the "oil-bath" type breather filters is also included.

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For more reviews of recent literature turn to page 124

Circle 28 on Reader Service Card

SAFEGUARDING INDUSTRY'S *Lifelines of Mobile Power*

Two Pioneers at Work

...27 YEARS AGO...and TODAY!

BAKER *pioneered*

THE HYDRAULIC CONTROLLED BULLDOZER

Eastman *pioneered*

HYDRAULIC HOSE ASSEMBLIES

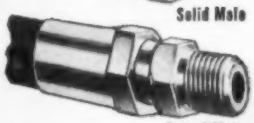
specify **Eastman** *first in the field*

HYDRAULIC HOSE ASSEMBLIES

for the best performance, for long life and satisfaction—*all along the line*—from manufacturer to user. Check your needs on the following list:

COUPLINGS

Solid Male



Swivel Male

Swivel Female

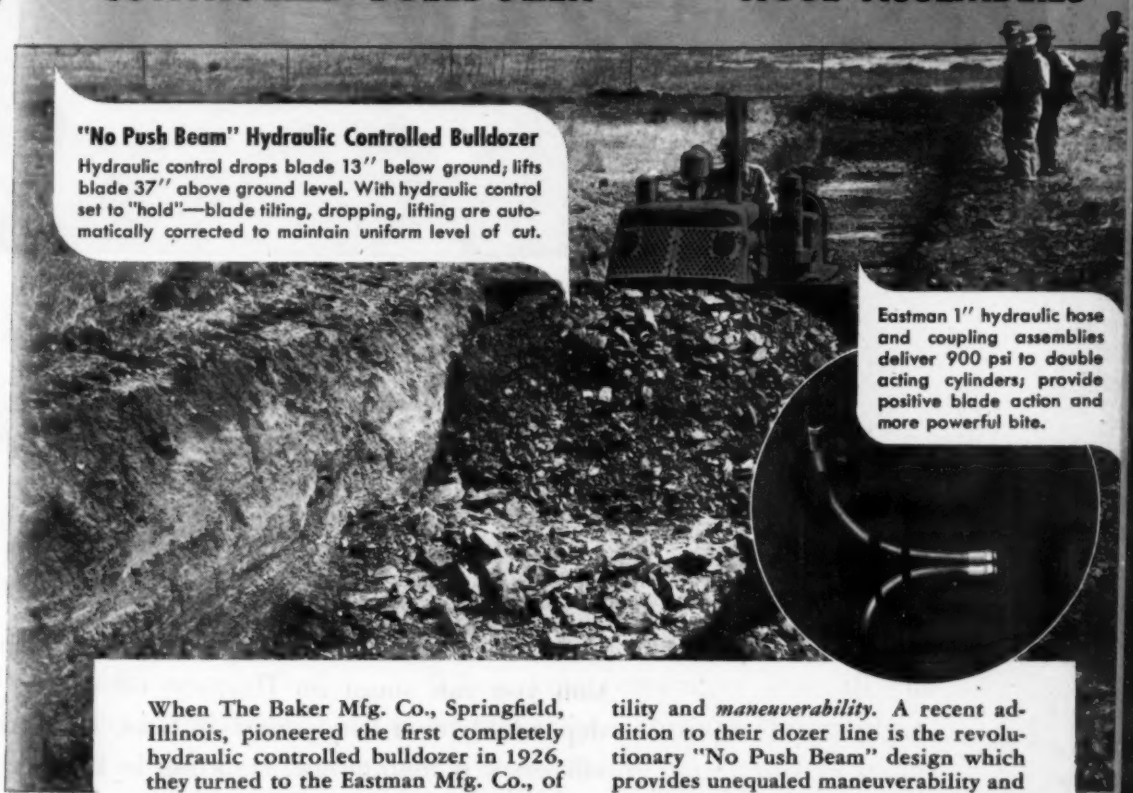
STRAIGHT AND ANGLED ADAPTER UNIONS

Straight Male

90° Male

45° Male

Write for free catalog 102 on Eastman Hose Couplings and Bulletins 231B & 232B on Straight and Angled Adapter Unions.



"No Push Beam" Hydraulic Controlled Bulldozer

Hydraulic control drops blade 13″ below ground; lifts blade 37″ above ground level. With hydraulic control set to "hold"—blade tilting, dropping, lifting are automatically corrected to maintain uniform level of cut.

Eastman 1″ hydraulic hose and coupling assemblies deliver 900 psi to double acting cylinders; provide positive blade action and more powerful bite.

When The Baker Mfg. Co., Springfield, Illinois, pioneered the first completely hydraulic controlled bulldozer in 1926, they turned to the Eastman Mfg. Co., of Manitowoc, Wis., who was pioneering in the field of hydraulic hose assemblies *at the same time!*

Then, as now—all through these years—Baker bulldozers have been equipped with Eastman Hydraulic Hose Assemblies *exclusively,* giving service in accord with the high standards that have made both Baker and Eastman leaders in their respective fields.

The enviable reputation of Baker "Dozers" is based upon their advanced engineering, plus their durability, versatility and *maneuverability.* A recent addition to their dozer line is the revolutionary "No Push Beam" design which provides unequaled maneuverability and floatation through a combination of unique mechanical linkage and hydraulic suspension.

Positive, dependable power is delivered to these controls through Eastman wire braided hydraulic hose, ranging from ¾″ to 2″ . . . carrying pressures up to 900 lbs. psi. Leakproof hydraulic couplings form the vital connecting links . . . another example of Eastman's leading role in *"Safeguarding Industry's Lifelines of Mobile Power."* Look to Eastman for leadership in this field.

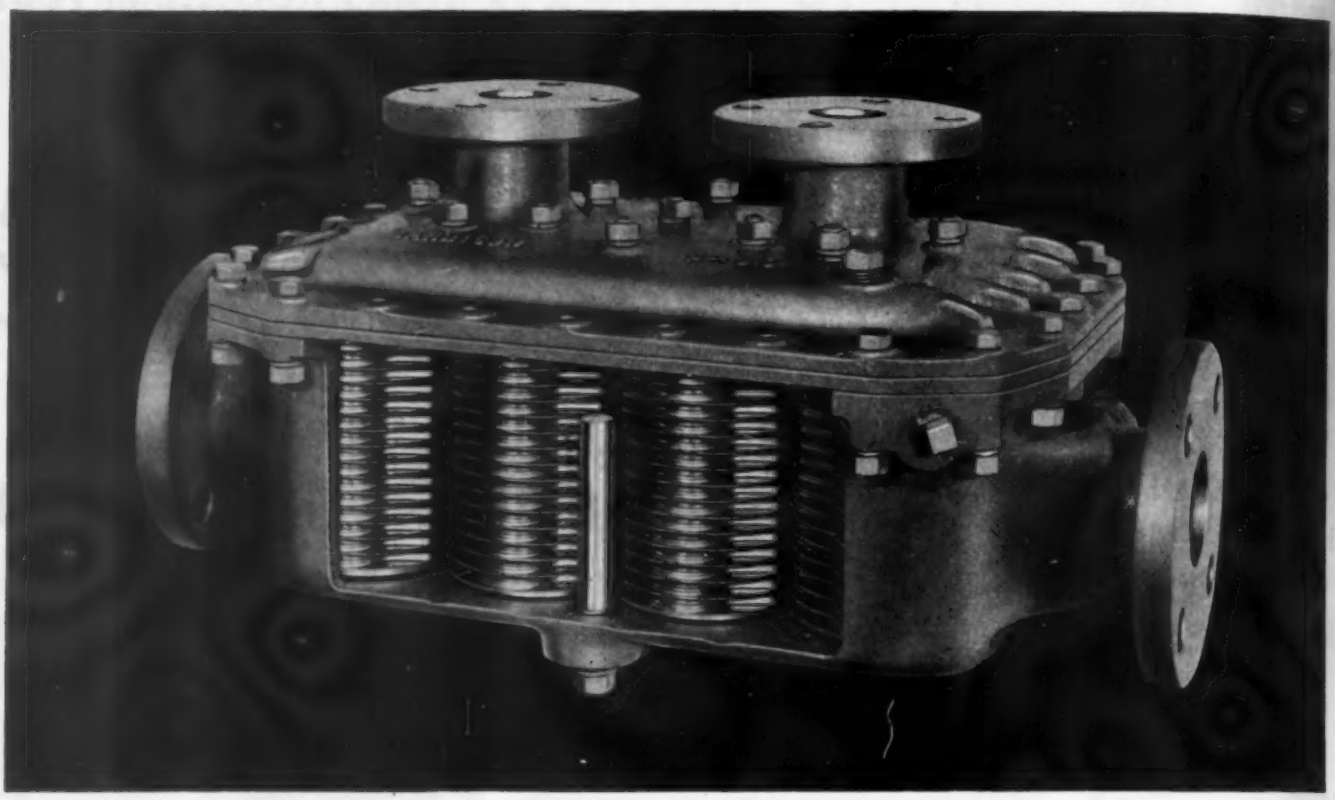
Eastman

MANUFACTURING COMPANY

Since 1914

Dept. AH11, Manitowoc, Wisconsin

HARRISON OIL COOLERS



keep temperatures in the working range

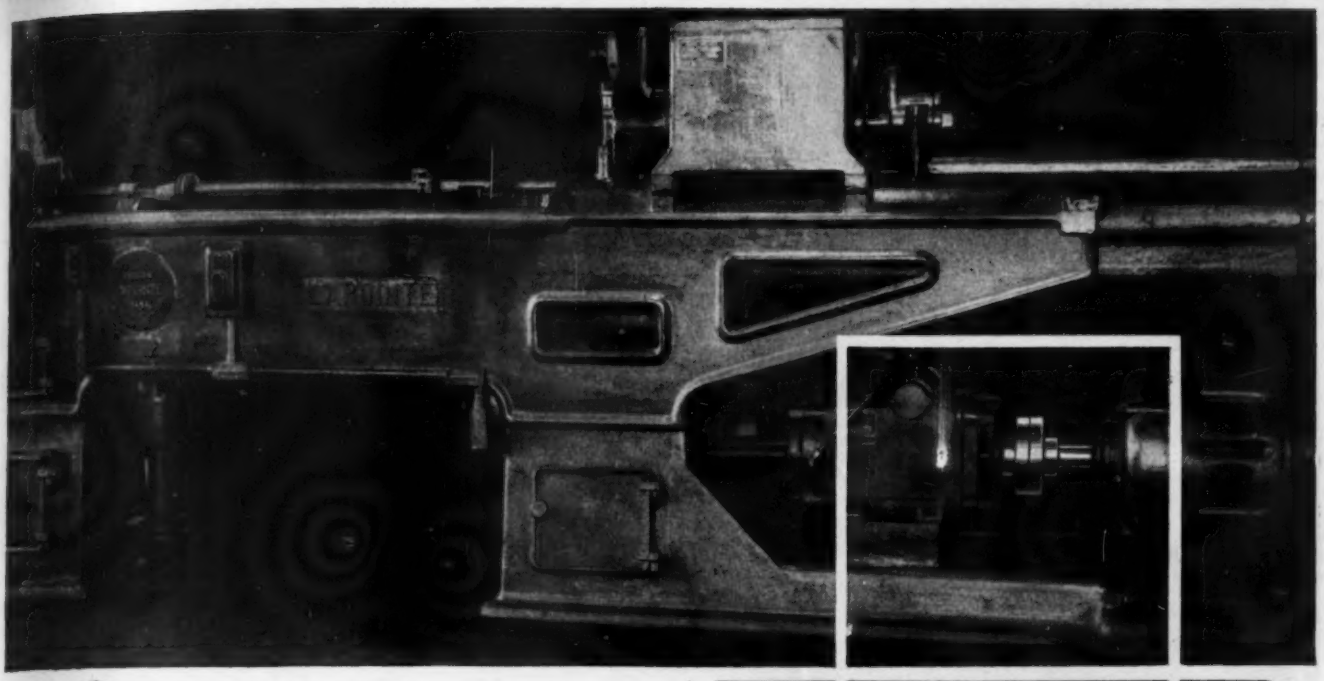
To attain top operating efficiency of hydraulic equipment, oil temperatures must be kept within a specified range.

Harrison oil coolers are designed to do just that. In addition you can count on Harrison oil coolers to function dependably over long periods of time. Thus, top operating efficiency is *maintained*, resulting in high, uninterrupted production.

Behind every Harrison oil cooler is the experience, the skill and the facilities developed in more than forty years of business.

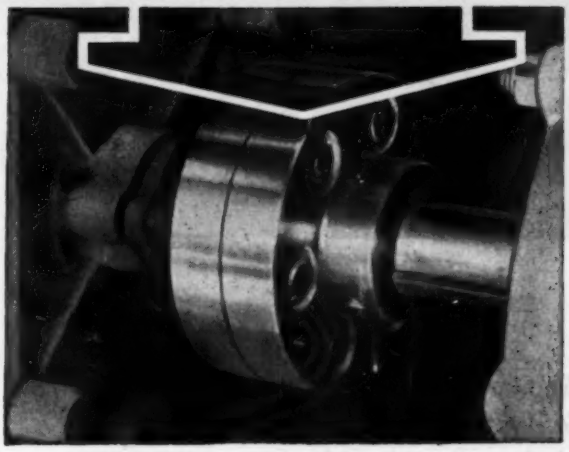
HARRISON
RADIATOR DIVISION
GENERAL MOTORS CORPORATION,
LOCKPORT, NEW YORK

HARRISON



AJAX

RUBBER-BRONZE BUSHED
FLEXIBLE COUPLING



10 YEARS ON THE JOB... MAINTENANCE ZERO

● This Ajax rubber-bronze bushed flexible coupling connects a 10 HP motor to the pump which develops pressure for hydraulic operation of a keyway broach.

It is a matter of job maintenance record that this Ajax coupling has never been off the shafts.

This performance record is typical of thousands throughout industry.

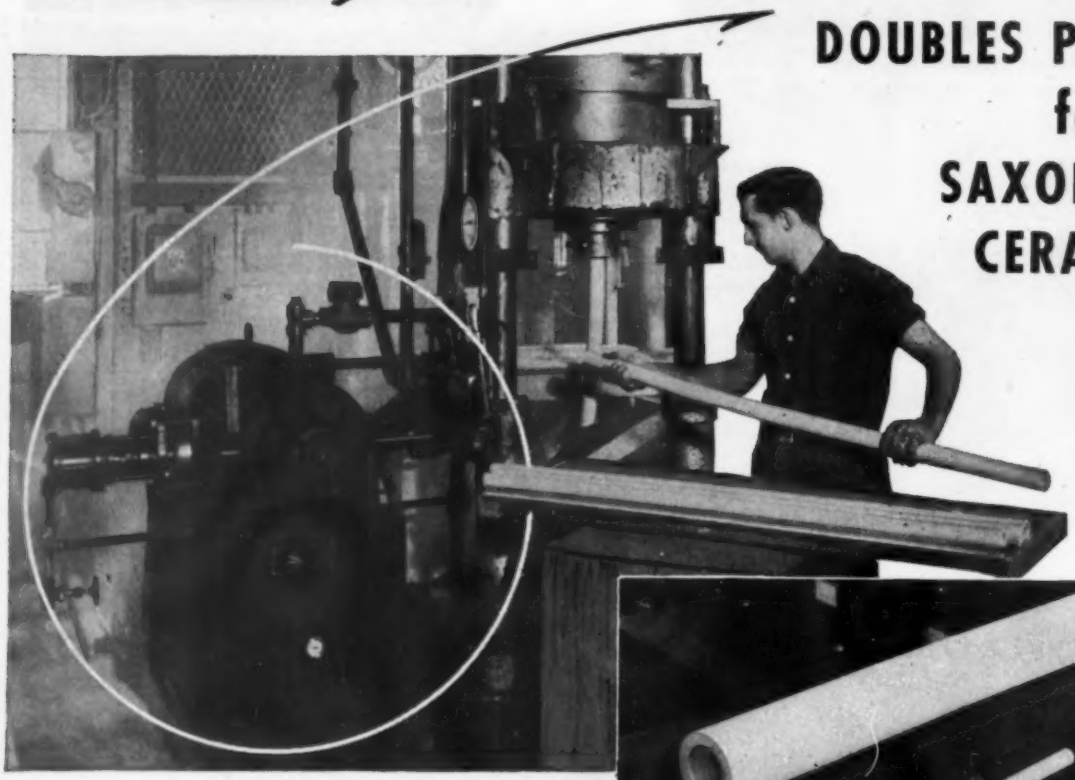
When you remember that all the horse power goes through the coupling, you will realize the importance of coupling performance. The cost of a quality coupling is insignificant compared to the cost of the machinery it protects and elimination of costly shut-downs and maintenance. Write for full information on Ajax Rubber-Bronze Bushed Flexible Couplings.

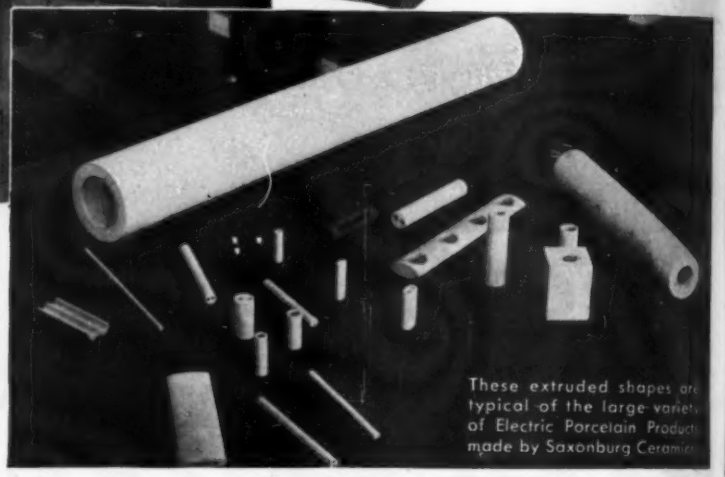
AJAX KNOWS COUPLINGS

AJAX FLEXIBLE COUPLING CO. INC. WESTFIELD, N.Y.

Lassman HYDRAULIC PUMP UNIT

DOUBLES PRODUCTION for SAXONBURG CERAMICS





These extruded shapes are typical of the large variety of Electric Porcelain Products made by Saxonburg Ceramics

Shown here is a completely packaged variable delivery Oil Hydraulic Pump Unit designed and built for Saxonburg Ceramics, Saxonburg, Pa. It operates at 3000 psi. Applied to it is one of Lassman's graduated dial volumetric controls which enables the operator to adjust the rate of extrusion.

This equipment eliminates trial and error in setting up the rate of extrusion for a production run. The operator first establishes the rate of extrusion for a given size hollow ware and for a given material. Then when the same size ware of the same material composition is again extruded at any future date the operator simply sets the dial at the previously established reading.

The use of this Lassman completely packaged hydraulic pump unit has doubled production and effected a great saving in time and material for Saxonburg Ceramics.

This performance is typical of Lassman designed and built hydraulic equipment. To meet your production requirements think first of Benjamin Lassman & Son, specialists in the hydraulic field for over 30 years.

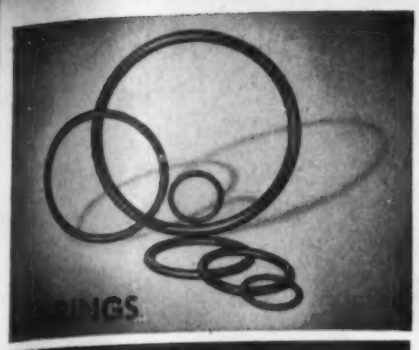
Representatives in Principal Areas

BENJAMIN LASSMAN & SON

ENGINEERS & MANUFACTURERS SINCE 1921

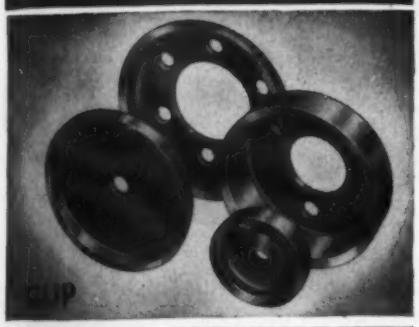
ROUTE 8, GLENSHAW (Suburban Pittsburgh), PA.

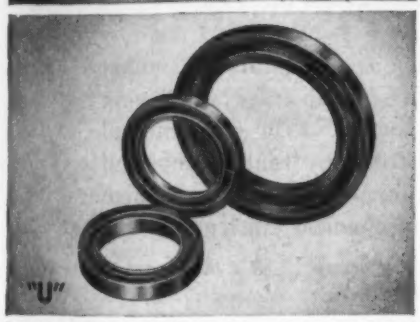
HIGH PRESSURE HYDRAULIC EQUIPMENT . . . APPLICATION & DESIGN.

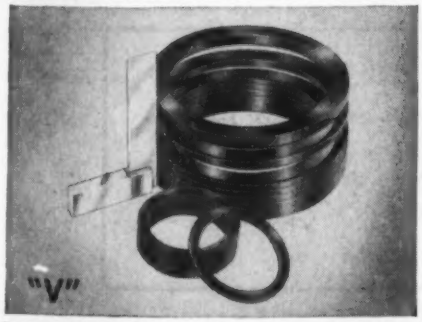


FLANGE PACKINGS

Made of leather or rubber. Installed in recess around a rotating or reciprocating shaft. Sealing lip and inner side wall form dynamic seal on shaft. Gland nose forms compression seal on shaft.







NOW . . . it's easier to order G&K-INTERNATIONAL Packings — always uniformly accurate

The Joint Industry Conference, together with packings manufacturers and government agencies, have set up dimensional standards for each packings type — identified by a Dash Number — making it easier for you to order, assuring greater accuracy and faster service.

You'll find all the code numbers in our new Packings Catalog and Manual — of course, we still require information as to mediums, pressures, temperatures.

But because G&K-International follows the standard specifications — we can save time for you. Our engineers and chemists are also ready to study your non-standard requirements and recommend special types of packings to function in hard-to-do jobs.

Call on G&K-International for *all* your packings needs.

Replacement Packings

Modern JIC standards are also simplifying the specs for replacement packings. However, thousands of presses and other hydraulic equipment require leather packings in the larger or non-standard sizes. Over the past 50 years we have produced many thousands of these packings, including leather U's and "crimps" up to 6 feet in diameter.

Consult G&K-International for your replacement needs. You'll find the answer here.

New Packings Catalog

A comprehensive Catalog and Manual covering all up-to-date packings standards you ought to know about for your packings and oil seal needs. We want you to have a copy. Tell us where to send it!

G&K GRATON AND KNIGHT INTERNATIONAL

GRATON & KNIGHT COMPANY
Established 1851
P-6 **Worcester 4, Massachusetts**

INTERNATIONAL PACKINGS CORPORATION
Graton & Knight Company Affiliate
Bristol, New Hampshire

In Gerotor hydraulic pumps . . .

and motors . . .

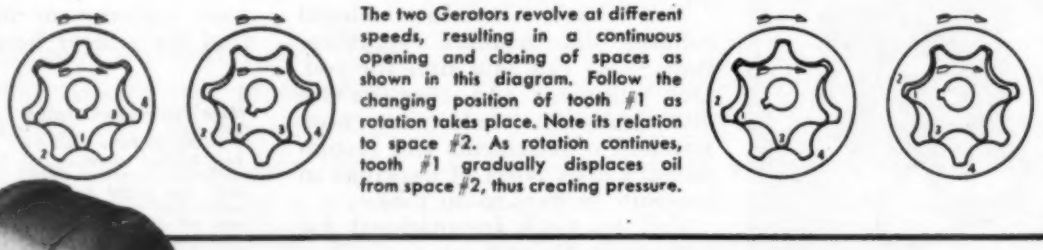
the GEROTOR*

makes the difference!

The patented Gerotor principle is represented by a pair of gear-shaped elements, one within the other. In pumps, power is applied through the shaft to the inner Gerotor and is transmitted in the closed mesh region to the outer Gerotor; in motors, the same principle operates in reverse.

Each tooth of the inner Gerotor is in sliding contact with the outer Gerotor at all times, providing continuous fluid-tight engagement at very low contact speed. The contact points revolve only once in seven to nine revolutions, depending on the type of unit. This reduced friction permits higher shaft speeds, assures longer life. Opening and closing of chambers between the teeth is gradual across long ports, eliminating sudden shock and excessive turbulence, and reducing pressure variations found in conventional gear pumps. In Gerotor hydraulic pumps and motors, the Gerotor principle produces high volumetric and mechanical efficiency.

**Gerotor is not just a name . . . it's the heart of the finest hydraulic pumps and motors made.*



The two Gerotors revolve at different speeds, resulting in a continuous opening and closing of spaces as shown in this diagram. Follow the changing position of tooth #1 as rotation takes place. Note its relation to space #2. As rotation continues, tooth #1 gradually displaces oil from space #2, thus creating pressure.

Whatever your need in hydraulic pumps or motors, consult the Gerotor May engineers. *Write for free literature.*

GEROTOR MAY CORP.
BOX 86
BALTIMORE 3, MD.

GEROTOR
HYDRAULIC PUMPS & MOTORS

For this PRODUCT

COLD DRAWN
SEAMLESS
STEEL TUBING

In these USES

MECHANICAL, PRESSURE,
AIRCRAFT and
DIESEL TUBING

In this RANGE

SIZES up to
1½" OUTSIDE DIA.

Specify SUMMERILL, and be sure!

For a great many years, specifying "Summerill" on orders for cold drawn seamless steel tubing has been a very sure way of getting completely dependable quality. It's more true today than ever, because we have the modern facilities and control equipment of a new plant to reinforce our traditional standards. ● *Let us supply you with footage produced to meet your demand for high quality tubing. Mechanical and aircraft tubing size ranges can be supplied on earlier deliveries than our other product lines.*

Summerill TUBING COMPANY DIVISION
COLUMBIA STEEL & SHAFTING COMPANY
Pittsburgh 30, Pennsylvania

WAD 4184

SPECIALIZING IN COLD DRAWN SEAMLESS STEEL TUBING

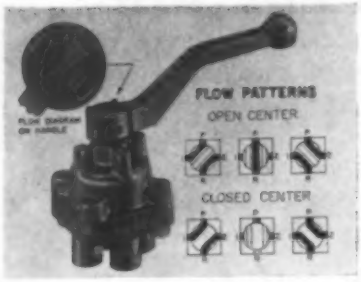
NEW PRODUCTS

Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.

CONTROL VALVE
. . . has pressure diaphragm

Designation: Type D-53
Sizes: Available in either ½ or ¾ in. pipe size.
Construction: All bronze with renewable chrome-plated valve seat of full port diameter, renewable composition seat disc, neoprene-nylon diaphragm. Rustproof steel bolting.
Features: Full port diameter means full capacity and low pressure drop through the valve. For maximum hookup flexibility, diaphragm pressure connection may be indexed to any of four positions—over inlet, over outlet, or either side. Maximum body pressure 250 psig; diaphragm pressure 300 psig.
Application: Typical use is on water cooled compressors. Also used wherever desirable to control line flow by application of an independent pressure applied to the diaphragm.

A. W. Cash
Valve Manufacturing Corporation
666 E. Wabash Ave.
Decatur, Illinois
Circle 226 on Reader Service Card



MANUAL VALVES
. . . for oil service

Designation: Shear-Seal
Sizes: Valves range from ¼ to 1 in. pipe size with full, unrestricted flow passage in all sizes.
Design: The straight porting of the 4-way series provides for manifolding with standard tees in the pressure and return ports. Extreme versatility has been incorporated into the design.
Features: Leak-proof closure, high flow capacity, low handle load, no freeze-ups, excellent throttling, no wire-drawing, not critical to dirt are inherent design features.

Barksdale Valves
5125 Alcoa Ave.
Los Angeles 58, California
Circle 227 on Reader Service Card

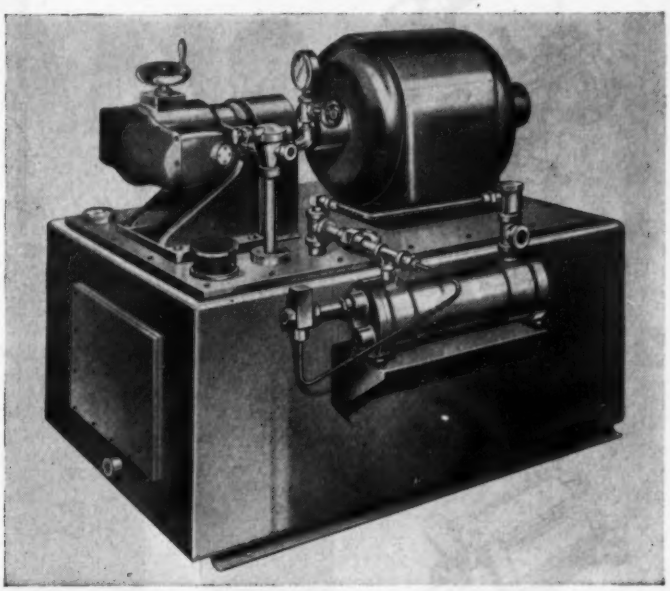
AIR COMPRESSOR
. . . with discharge pressure of 2500 psi

Designation: Model 32R1500
Features: The 3-stage compressor is engineered for V-belt drive with any power source of ½ hp or greater. It will compress 70 cu. ft. of free air to 2300 psi in 100 minutes at 5000 rpm. It has an ambient temperature range of 0 F to 160 F. The compressor has a rated discharge pressure of 2500 psi.
Construction: The compressor is air cooled and supplied with a relief valve and gauge. To ensure exclusion of oil mist or fumes during compression, a combination filter and moisture separator is available. Other features include an integral oil reservoir and oil pump.
Application: The air compressor is designed to charge industrial breathing equipment and other such similar gear for use by personnel during temporary exposure to noxious poisonous fumes.

The Cornelius Co.
550 39th Ave.
Minneapolis 21, Minn.
Circle 228 on Reader Service Card

For more New Product Information turn to page 110

MORE MACHINE MANUFACTURERS INSTALL MARVEL SYNCLINAL FILTERS AS ORIGINAL EQUIPMENT

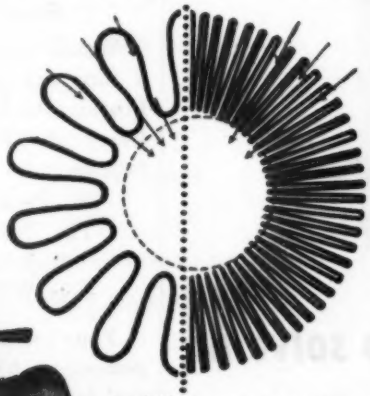


Large series hydraulic pumping unit manufactured by The Denison Engineering Co., Columbus, Ohio to recommendations of the Joint Industry Conference. These pumping units are equipped with Marvel Synclinal Filters.

They Know That ONLY ACTIVE FILTER AREA COUNTS!

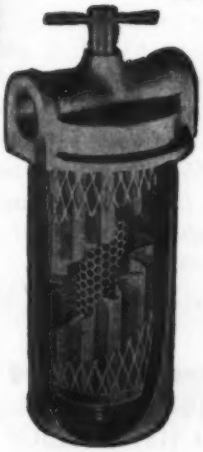
It isn't the total amount of filtering mesh that may be squeezed into a filter unit but the amount of ACTIVE, WORKING filter mesh that counts. Surplus mesh not only fails to filter but obstructs the passage and slows the flow. A too crowded unit does not have adequate space for storage of accumulated foreign matter—tightly packed pleats of mesh can soon become clogged with filtered out material. Marvel Synclinal Filters are balanced to provide maximum mesh area for all the liquid which can pass through the space and allow necessary room for filtered out material. That is why they excel in maintaining efficiency through longer periods between cleanings. Not only is the frequency of cleaning reduced but disassembly, cleaning and reassembly is so simple that any workman can do it quickly.

SUMP TYPE (Cutaway)



MARVEL BALANCED SYNCLINAL DESIGN

UNBALANCED BY INACTIVE FILTER AREA



LINE TYPE (Cutaway)

Meets J.I.C. Standards

WATER FILTERS

In response to the great demand, we have adapted both our sump and line types for use in all water filtering applications. No changes have been made in the basic synclinal design.

FACTS—NOT CLAIMS

Engineers decide on the basis of the record, on the basis of measurable facts rather than on claims of the "campaign promise" variety. Here is a fact with meaning:

OVER 400 MANUFACTURERS make MARVEL SYNCLINICAL FILTERS their O.E.M. Choice

Marvel filters are available in sump and line types, in capacities from 5 to 100 g.p.m. (multiple installations effect greater capacities), and in wire mesh sizes from 30 to 200. Line types operate in any position and may be serviced without disturbing pipe connections. For efficient filtration of non-corrosive liquids in all HYDRAULIC and LOW PRESSURE systems investigate Marvel Synclinal Filters.

COUPON

Marvel Engineering Company AH-11
625 W. Jackson Blvd., Chicago 6, Ill.

Without obligation, please send me complete data on Marvel Synclinal Filters as follows—

Catalog #106 for Oil Filters
Catalog #300 for Water Filters

Name .....

Company .....

Address .....

City ..... State .....

MARVEL *Engineering Company*

625 WEST JACKSON BLVD., CHICAGO 6, ILLINOIS

What's your problem in power motion?

There's an Anker-Holth cylinder to solve it!

● Advanced designs of Anker-Holth power cylinders in a wide range of sizes and types are available to solve your problems involving push, pull, lift or lowering action. If standard cylinders aren't the answer, Anker-Holth matches your needs with special designs.

For help in engineered cylinder power . . . air or hydraulic . . . write Anker-Holth Division of The Wellman Engineering Company, Dept. C-6, 2723 Conner St., Port Huron, Michigan.

FREE on request . . . bulletin on complete line of Anker-Holth products.

Anker-Holth
ENGINEERED CYLINDER POWER
WELLMAN
Division of THE WELLMAN ENGINEERING COMPANY

LETTERS to the Editor

Background for Flow Control

Could you give us the names of some treatises or information on flow control?

L. D. H. ANDERSON,
Anderson Engineering Co.

If you mean oil flow control, Walter Ernst's "Oil Hydraulic Power and Its Industrial Applications" and H. G. Conway's "Fluid Pressure Mechanisms" will probably give you the most specific information. For air flow control technical bulletins of such companies as The Foxboro Company would probably be helpful. If you can be more specific as to your flow control problems we probably could be more helpful.

Sources for Large Capacity Four-Way Valves

Would you give us sources for a four-way hydraulic valve, specifications to be 1500 psi and a delivery of 53 Imperial gallons per minute.

W. PROUDMAN,
The Northern Engineering & Supply Co. Ltd.
Fort William, Ontario, Canada

Your requirement of 53 Imperial gallons or 63.6 U.S. gallons would call for either a 1½ inch or 2 inch size. Leading U.S. valve manufacturers rate their 1½ inch valves at 60 to 65 gallons per minute at 2000 psi. A list of the manufacturers of hydraulic directional valves has been sent to you.

Hydraulic Cranking Systems

In the September issue of APPLIED HYDRAULICS an erroneous statement was made in the article "New Hydraulic Cranking System for Automotive Engines." In the fall of 1948, Greer Hydraulics, Inc. displayed a public demonstration of a hydraulic cranking

Continued on page 22

FOR PRESSURES UP TO 5000 P.S.I.

HYDRAMITE

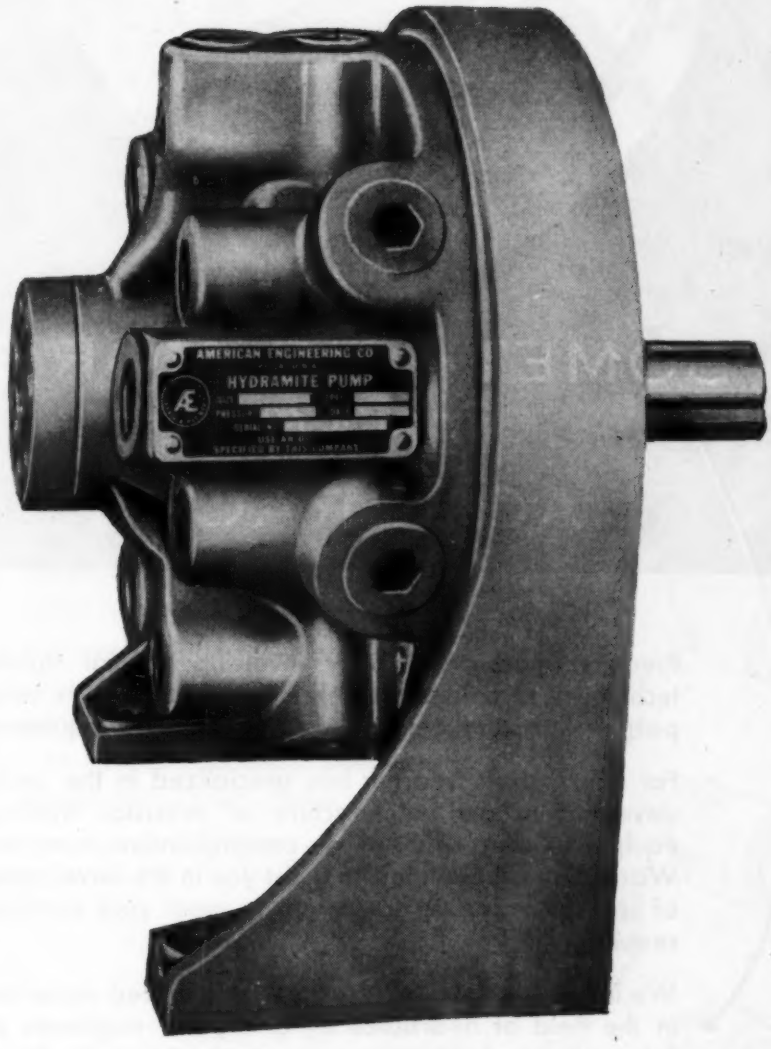
IS TODAY'S BEST PUMP... AND COSTS LESS

IN THE FEW YEARS since the Hydramite Pump was introduced it has become the top choice for an ever-increasing range of hydraulically-operated equipment...and has unfailingly brought the efficiency and economy which are always associated with products of the American Engineering Company.

The Hydramite Pump is available in a variety of sizes... develops pressures up to 5000 p.s.i. It operates on any of the makes and viscosities of oil which are suitable for hydraulic circuits.

• • •

Write for folder giving full information on the unique Hydramite Pump... and call on AE engineers or representatives for recommendations regarding possible applications.



WHEN IT'S HIGH PRESSURE, IT'S AMERICAN

AMERICAN ENGINEERING COMPANY

2530 ARAMINGO AVE., PHILADELPHIA 25, PENNA.

IN CANADA: AFFILIATED ENGINEERING CORPORATIONS, LTD., MONTREAL 2, P. Q.

SERVING THE HYDRAULICS INDUSTRY FOR OVER 30 YEARS

AE Products include: Hydramite and Hele-Shaw Fluid Power, Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Lo-Hed Hoists, Lo-Hed Car Pullers

Precision machining ability involving special lapping techniques to hold extremely close tolerances is only a part of the story behind Warner Hydraulic Equipment.

For many years Warner has specialized in the design, development and manufacture of precision hydraulic equipment. As a result of this comprehensive experience Warner is well qualified to assist you in the development of special hydraulic equipment to meet your particular requirements.

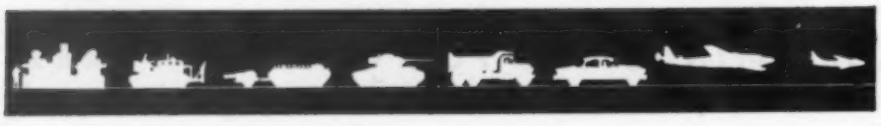
We invite you to utilize Warner's specialized experience in the field of hydraulics by giving our engineers and laboratory technicians an opportunity to work with you in the early stages of design and development.

Send today for your copy of an illustrated folder describing typical examples of Warner Hydraulic Equipment.

Warner DIVISION OF DETROIT HARVESTER CO. OF N. Y. INC.

21537 GROESBECK HIGHWAY • P. O. BOX 3886 • DETROIT 5, MICHIGAN

DESIGNERS AND MANUFACTURERS OF PUMPS • VALVES • ACTUATORS



Letters to the Editor

Continued

system. This was at the National Power Show in New York. The Greer hydraulic accumulator was used to furnish the hydraulic power to turn the starting motor developed by Jack & Heintz Industries. We feel that the coordinated effort of Jack & Heintz and Greer was the forerunner in developing and building the first successful hydraulic cranking system for diesel engines.

JULIUS KENDALL,
Vice President—Sales,
Greer Hydraulics, Inc.
Brooklyn, N. Y.

Thanks, Mr. Kendall. You are correct as far as a hydropneumatic bag type accumulator incorporated into a hydraulic cranking system is concerned. Information as to the first piston-type accumulator in a hydraulic cranking system, as furnished us, is that such a system was shown to prospective users in 1946.

Piston Accumulator MIL Spec

I read with interest the article "The Development of Cylindrical Piston Accumulators" in your August issue. Could you tell me where we could secure a complete copy of MIL specification A-5498-B.

D. I. BROWN,
Market Development Mgr.,
Koldflo Division,
Mullins Mfg. Corporation
Salem, O.

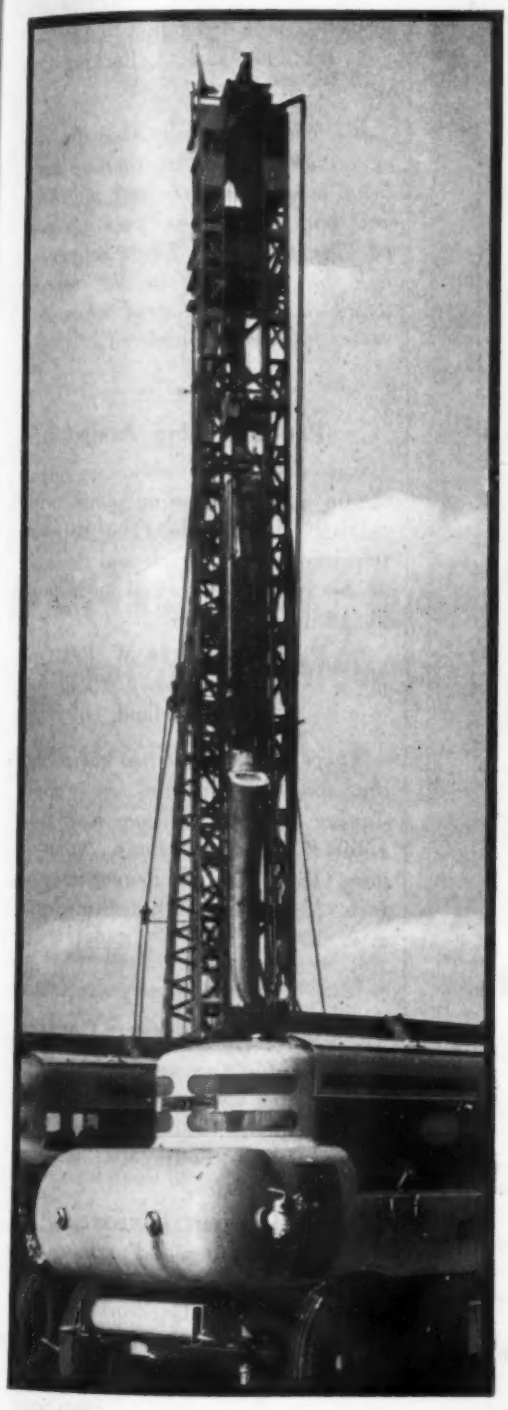
The nearest office of an Air Force Procurement Office or a BuAer office can furnish this or other MIL or AN specification in which you might be directly interested. We have asked the local BuAer representative to send a copy of MIL A-5498-B directly to you.

"Chevron" Type Packings

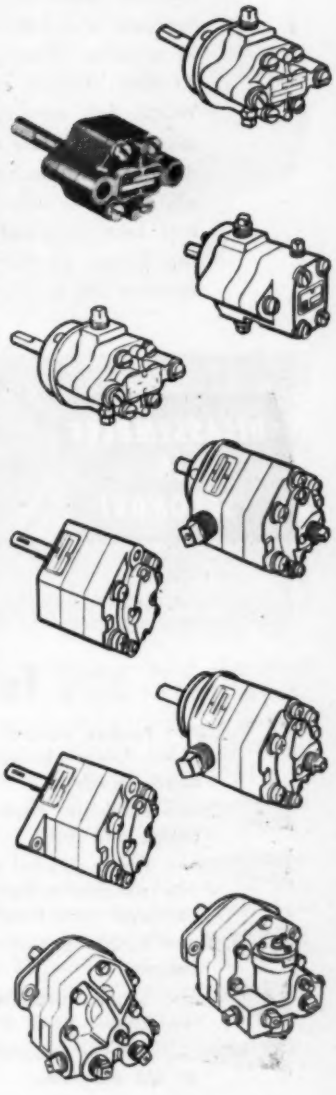
In the September 1953 issue of APPLIED HYDRAULICS an improper usage of the word "Chevron" was used in Table 2 on page 74 and in the paragraph headed "Packings" on page 76. We are very much concerned over this usage of our registered trade-mark

Continued on page 24

If You, too, Prefer a Built-in Hydraulic Pump...



Choose Yours from WEBSTER'S *90 types*



• The WEBSTER pump on this Joy Portable Compressor is face-mounted on the crankcase and gear-driven from the crankshaft. It is a compact, durable, positive displacement helical gear-type pump which provides force-feed lubrication.

This is but one of 90 types of WEBSTER Oil Hydraulic Pumps with capacities from 10 gph to 10 gpm—at pressures up to 1200 psi—speeds to 3600 rpm—with or without built-in relief valves—for sealed or wet sump mounting. One of these models might very well suit your needs because their custom-built design permits easy adaptation to your system.

***Write** today for catalog containing performance charts and pump data sheets on which you can describe your requirements.*

OIL HYDRAULICS DIVISION

WEBSTER ELECTRIC

RACINE, WISCONSIN

ESTABLISHED 1909

"Where Quality is a Responsibility and Fair Dealing an Obligation"

MANUFACTURERS OF A COMPLETE LINE OF OIL HYDRAULIC PUMPS

DOUBLE MACHINE LIFE

THROUGH POSITIVE FILTRATION OF HYDRAULIC-LUBRICATING OILS

GENERAL AF-500 *Industrial* FILTERS

GENERAL AF-500 FILTERS are designed to do just one thing—provide low-cost, day-by-day protection of hydraulic and lubricating oils used in quality machine tools. The AF-500's highly absorbent ALL-WOOL felt cartridge safely traps solids and moisture *before* they can damage vital machine parts. Costly oils and other industrial liquids are thus kept completely clean, assuring better performance, longer machine life, and low maintenance.

Cleanable wool felt cartridge quickly removed simply by unscrewing center bolt and lifting off cover and washers.

AF-500 for New or Old Equipment

- Positive absorbing action removes particles as fine as 5 microns. Safely filters lubricating and hydraulic oils, paints, lacquers, and other heavy liquids.
- Eliminates harmful condensation moisture, eliminates formation of sludge and rust.
- Finest all-wool felt cartridge easily cleanable in a few minutes in any suitable solvent. Single-bolt assembly allows quick removal of cartridge from filter—without disturbing piping.
- 15-20 gallons per minute capacity depending upon liquid viscosity.
- Simple installation plan. Allows inlet to be turned to top or bottom —whichever gives the best space and piping accommodations.
- Equally adaptable as original or replacement equipment—on new or old machines.

REMEMBER—We'll gladly advise you without obligation on any filtering problems.

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43800 GRAND RIVER • NOVI, MICHIGAN
CANADIAN GENERAL FILTERS, LTD.
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Letters to the Editor

Continued

as a generic term. We are determined to protect our rights to the exclusive use of that mark.

R. J. HINKLE,
Vice President
The Garlock Packing Co.
Palmyra, N. Y.

We are sorry that this slip occurred and written instructions have been issued to our staff members and contributors on packings and packing problems. These references will be corrected in the reprint which will be prepared when this series has been completed.

Proportioning Pump

Can you tell us where we might obtain a proportioning pump, with valving if possible. The delivery requirement is 5 gpm and the unit to be operated is a 3 inch bore by 12 foot cylinder.

ELMER W. PFEIL,
Elmer W. Pfeil Co.
Cleveland, O.

There are at least two companies that specialize in small size proportioning pumps: Milton Roy Co., 1300 E. Mermaid Lane, Philadelphia 18, Pa. and Proportioneers, Inc., 345 Harris Ave., Providence 1, R. I.

Back Issue of Beginners Courses

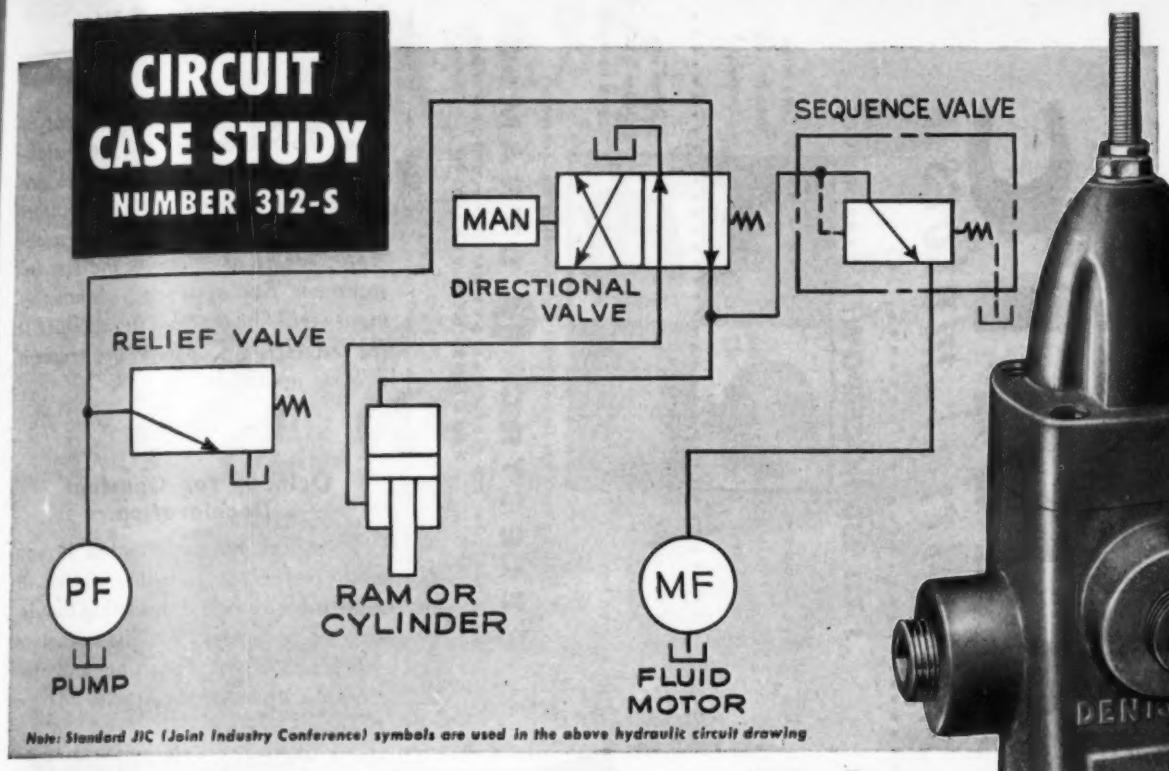
We would be very pleased to receive tear sheets of your articles on "Beginners Course in Basic Hydraulics" and "Beginners Course in Basic Pneumatics."

HERBERT LAYPORT,
Manager of Purchases,
Worcester Division,
Wyman-Gordon Company
Worcester, Mass.

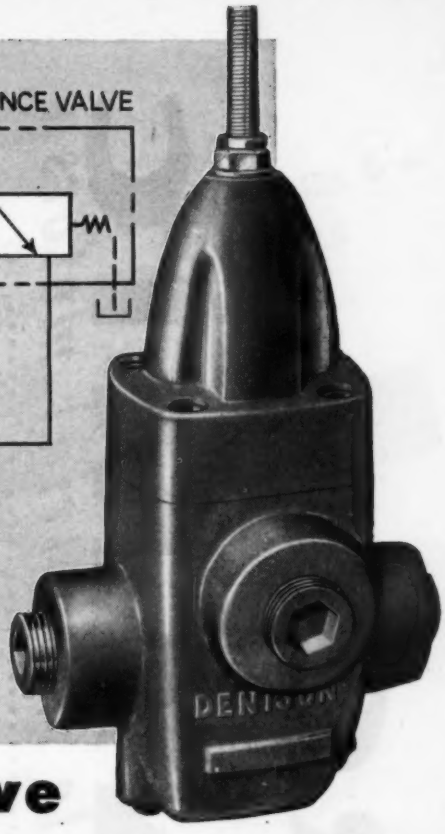
The "Beginners Course in Basic Hydraulics" ran in the 1950-1951 issues of APPLIED HYDRAULICS and was not reprinted. Practically all of these issues are now out of print. The "Beginners Course in Basic Pneumatics" began in our February, 1952 issue. Because of the demand for extra copies, many

Continued on page 26

CIRCUIT CASE STUDY
NUMBER 312-S



Note: Standard JIC (Joint Industry Conference) symbols are used in the above hydraulic circuit drawing



DENISON Sequence Valve

controls oil flow to secondary circuit with *quick, direct action*

Above, you see a typical circuit utilizing a Denison **Sequence Valve** of the direct-operating type. Here, oil pressure is developed by a fixed-displacement pump. When the manual control of the directional valve is held open, pressure is directed to a cylinder, which performs the primary operation. As the piston rod of the cylinder meets resistance, pressure increases. When the increasing pressure equals pressure setting of the **sequence valve** (which is easily adjusted to any operating need) it acts upon a small pilot piston in the **sequence valve**, shifting the valve spool. Oil flow is now open to both the cylinder and to secondary operation, performed in this case by a fluid motor. Additional sequence operations could be provided in similar manner.

Pressure build-up at the primary operation brings quick action on the spool of the **sequence valve.** The pilot piston, which eliminates the need for heavy spring loading of the valve spool in circuits operating at pressures above 250 psi, is not employed in models designed for lower pressures. Instead, pressure acts directly against the valve spool, assuring high sensitivity to low-pressure changes. These **sequence valves** are externally drained.

Denison direct-operating **sequence valves** provide positive action at relatively low cost, for circuit pressures from 25 to 2000 psi, and are readily adaptable to remote control arrangements. Denison also makes hydrostatically-operated **sequence valves** for pressures to 5000 psi.

Denison direct-operating pressure control valves are available in a wide range of models, for relief, unloading, counterbalance and sequence needs —with or without remote control and built-in checks. All are available in ½, ¾, 1 ¼, 1 ½ inch sizes, for all pressures to 2000 psi. Choice of threaded, subplate, or flange connections. We invite your inquiry on circuit needs of this type — or write for bulletin VRD.

Denison offers one of the most widely practical lines of oil hydraulic pumps, motors and controls for circuits operating at pressures up to 5000 psi. Designed and built with skill and knowledge gained through twenty-five years of engineering leadership in oil hydraulics, they offer the compact ruggedness needed for exacting, heavy-duty demands. Wherever you need closely adjustable power and control with unlimited flexibility of application, specify Denison HydrOILic Equipment. Your request for information will not obligate you in any way.

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Extra dependable industrial motors
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Letters to the Editor

Continued

of the older issues are now out of print. Tear sheets of the few installments that we can still furnish are being sent to you. For your information, we plan to reprint the pneumatic series as soon as the last installment has appeared. Announcement will be made in APPLIED HYDRAULICS when the reprint will be available.

Orifices for Constant Deceleration

It would be appreciated if you could refer me to some source or send information concerning the design of orifices to produce constant deceleration in absorbing and dissipating undesirable kinetic energy.

ALBERT MIGLIACCIO,
Head, Prototype Development Sec.,
U. S. Naval Ordnance Test Station,
Pasadena 8, Calif.

The technical literature on this subject, as far as we are aware, is confined to research work done by several valve and synthetic rubber compound manufacturers. Pertinent work done and being done by valve manufacturers in the industrial field may be available soon from the Valve Division, National Fluid Power Association. In the synthetic rubber field, such organizations as the Battelle Memorial Institute, Columbus, O., and Vernay Laboratories, Yellow Springs, Ohio, may be helpful. We assume you have access to the two major aircraft Services' research and testing programs including special development contracts.

Search for a Small Pump

After some weeks of effort, we are still unable to locate a source of pumps suitable for operation by a 1/3 hp motor and developing pressure in the 1500-2000 psi range. We would be very appreciative of any help in locating such a pump.

H. J. HULSART,
Dexter H. Hulsart Co.
Tuscaloosa, Ala.

You outline a rather unusual re-

Continued on page 28

Compactness

IS THE RULE ON ALL

Pathon

SERIES R H 2000 P.S.I. and SERIES Q H 1000 P.S.I. HYDRAULIC CYLINDERS

On all of your hydraulic cylinder applications the appropriate Pathon cylinder will give you the minimum in mounting size with increase strength and fatigue life.

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LOW STRESS CONCENTRATION through the head to barrel attaching area providing a plus factor for shock loads. The single screw thread attaching method gives maximum strength in minimum space.

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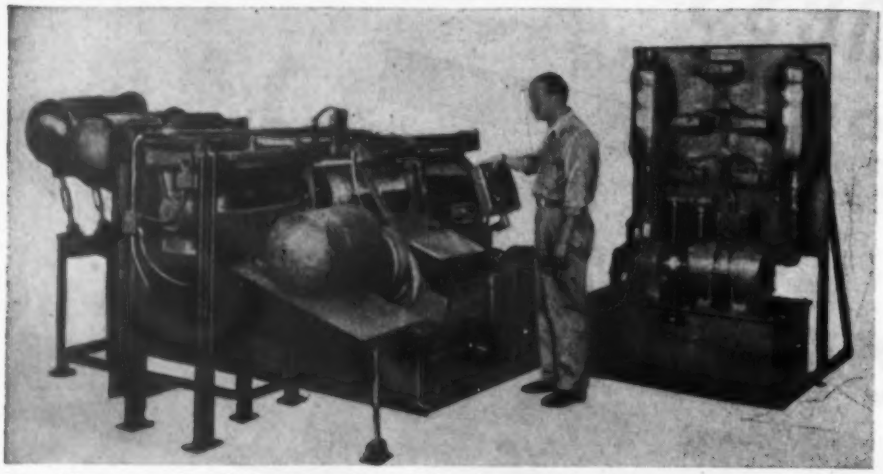
AIR CYLINDERS...HYDRAULIC DIRECTIONAL CONTROL VALVES...HYDRAULIC CYLINDERS

Circle 84 on Reader Service Card

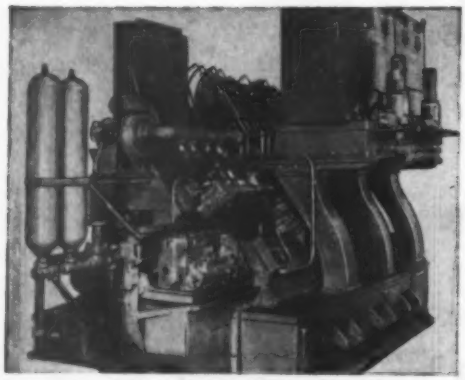
GREER TOPICS

Functions and Applications of the Greer Accumulator



Bunell's automatic cylinder trimming and forming machine incorporates two Greer accumulators to cut motorpump unit size by 50%. Slashed cost $600, weight 400 pounds and saved substantial floor space. Simpler circuit used few fittings for less maintenance.

How Greer Accumulators Reduce Power Requirements



Kreuger's huge Insert Valve Press uses 4 Greer accumulators to supply power needed to insert valves in auto cylinder blocks. The Greer accumulator reduced motor and pump requirements and assured the smooth, even flow of oil under pressure on circuit demand.

They store tremendous power in small space—deliver it instantly on demand of hydraulic system

As a primary source of hydraulic power where the work cycle does not depend on the flow of the pump or as auxiliary power in intermittent duty systems, the Greer accumulator has its most dramatic effects. In these applications, the Greer accumulator can save a great deal of power, reduce size and cost of equipment, and develop a much more efficient hydraulic circuit.

This compact and economical power package, with its unmatched ability to store power in small space, accumulates energy from the pump and delivers it instantly as required by the circuit, permitting small motors to do the work of big ones. For practical applications, read about the installation of Greer accumulators on the equipment as shown in photographs above and on left.

Greer's staff of expert hydraulic engineers are available for a discussion of your problem without obligation. Call or write Greer today.

Greer Hydro-Pneumatic Accumulators have many other diversified functions

(1) Pressure storage chamber for main, auxiliary and emergency power (2) Pressure-volume compensator for leakage and temperature (3) Dispenser of fluids and lubricants (4) Transfer-barrier for fluids and gases (5) Shock absorber for line shock and pump pulsation.

Precision engineered to make any hydraulic system better! Complete data and diagrams in Brochure 301. Write for your free copy.

GREER ACCUMULATORS

U.S. PATENTS UNDER OLAER LICENSES

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Field Offices: 1908 West Cermak Road, Chicago, Illinois • 25 South Main Street, Dayton, Ohio 2832 East Grand Boulevard, Detroit, Michigan • and sales representatives in all principal cities

Letters to the Editor

Continued

quirement in that you start with a pressure range and a definite power source. However, at 1500 psi this power source would deliver a little over 1/3 of a gallon per minute (.376 gpm). A very small pump would do the job. There are small gear pumps being offered in standard units which would meet your requirement.

4000 psi Hydraulic System for Aircraft

A notice entitled "In Coming Issues . . ." on page 116 of your July issue calls attention to an article "Detailed Description of the 4000 psi Hydraulic System on the Bristol Britannia". We are making a study of the optimum pressure for aircraft hydraulic systems and, since we have a deadline for our completion date, could you tell us when this article is to appear

G. GESSNER,
Electro-Mechanical Engineer,
The Glenn L. Martin Company
Baltimore, Md.

We are happy to tell you that this article appears in this issue. Prepared in Great Britain, the hydraulic system described represents an important development in high pressure oil circuits for aircraft.

"Servomechanisms for Industry"

In the September issue of APPLIED HYDRAULICS you have an installment "Servomechanisms for Industry" in what apparently will be a series of several articles. The context of the first article appears to provide basic information for the understanding of this general subject, and it would be appreciated if two copies each of the tear sheets of this article, and the following in the series, be sent to us for training and information purposes.

D. A. WEBSTER,
Group Engineer,
Mechanical/Hydraulic Group
Lockheed Aircraft Corp.
Marietta, Ga.

Arrangements are being made to

Continued on page 30

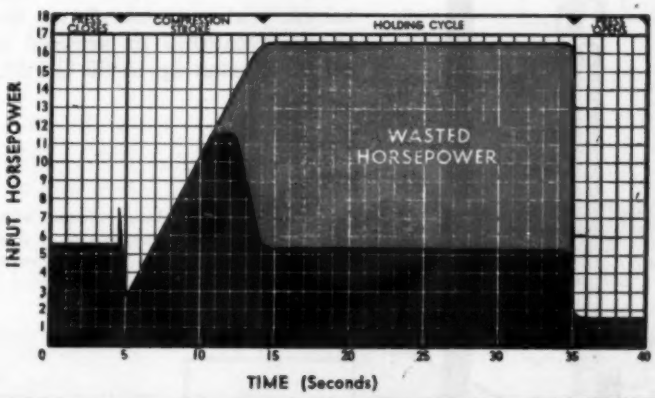
FULL VOLUME HIGH PRESSURE

. . . BUT LOW HORSEPOWER with RACINE *Hydraulic* PUMPS

High pressure holding is economical with RACINE Variable Volume Pumps. They will automatically cease their pumping action but maintain full pressure in the system. Instant change from no volume to full volume insures smooth, sure application of hydraulic force. Horsepower requirements are measured by the actual needs of the job — all of the oil is put to work.

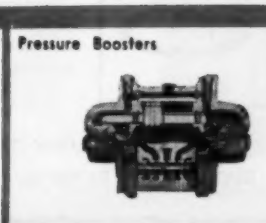
RACINE Variable Volume Pumps eliminate the need for relief valves — reduce oil heating — save horsepower and lower the over-all cost of most circuits.

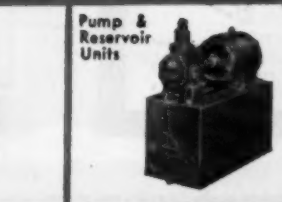
Various standard governors are available for RACINE Pumps. These governors develop the pumping action that will best handle special requirements of the circuit. Maximum efficiency is assured.



The graph to the right illustrates the horsepower savings in a simple press circuit using a RACINE Variable Volume Pump and Pressure Booster. The colored area represents the bypassed oil from a constant volume pump —lost power that is saved with RACINE Equipment.

OTHER RACINE HYDRAULIC PRODUCTS





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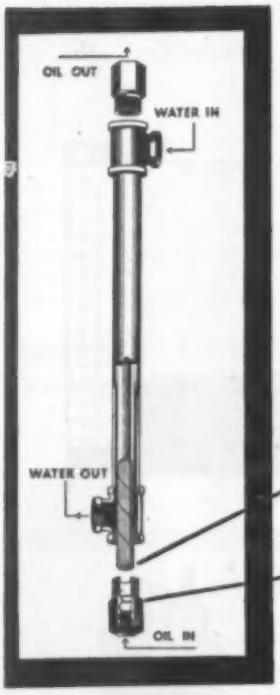
Something New in Oil Cooling

heat-x INNER-FIN OIL COOLERS

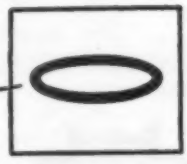
Longitudinal inner-fin construction, exclusive with Heat-X, makes possible this compact, economical oil cooler. Generous inner-fin surface permits more cooling in less space . . . with minimum pressure drop.

Unequalled for many applications, including hydraulically operated machines, turbines, diesel and gasoline engines, torque convertors, gears, compressors, transformers and similar applications.



Oil flows through the inner-finned tubes, water counterflows through the shell. Available in several sizes, with oil flow rates up to 60 G.P.M.

Inner-finned element is all copper and is easily removable for cleaning or replacement.



"O" rings provide positive seal between oil and water . . . eliminate all soldered and packed joints and gaskets

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THE HEAT-X-CHANGER CO., Inc.

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Letters to the Editor

Continued

publish this series, which will run to three installments, as soon as the last installment has run in APPLIED HYDRAULICS. Two copies will be reserved for you.

We're sorry, but we are completely out of back issues which carried installments of the Hydraulics Course. However, copies of the APPLIED HYDRAULICS Data List are available. The list gives reviews of books and other literature in the Fluid Power Field.

A Groove Design Problem

I am in the process of making a solvent dispenser for pumping solvent into a water jug. My pump is ½ inch ID. I am using ⅝ inch brass tubing with .065 wall, thus making the ID from .004 to .005 under ½ inch. I attempted to use an "O" ring (½ inch x .0625) in a groove 1/16 inch wide and 1/16 inch deep. It was still too hard to pump for a manually operated pump. Would it be better to use a tubing larger than ½ inch ID and stretch the ring to proper size or would a leather ring or packing work better? The solvent has an alcohol base.

GORDON B. DOYLE, JR.,
College Park, Md.

Since the answer to this problem was one for a packing specialist, we referred this information to two packing manufacturers. At press-time we had one answer, which follows:

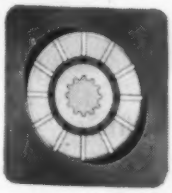
It seems to us that a cup packing in your application might be more suitable than the "O" ring packing which you have tried. For "O" ring packing, we would refer you to Military Specification MIL-P-5514A, in which you will find detailed installation and design characteristics of hydraulic packing. While a number of sources, including our own company could supply standard "O" rings to AN Specifications, we question the feasibility of using a ring in a groove as proposed. While we do not make a standard line of cup packings at present, we are sending (Mr. Doyle) a piece of .032 inch Teflon sheet from which to form a cup washer of suitable dimensions.

When Tractor Hydraulic System has a VICKERS® Balanced Vane Type Pump

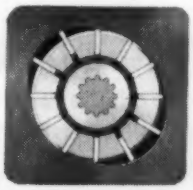
Under the very best conditions, cold weather puts a strain on starting equipment. Every part of the engine is stiffer, and the cold seriously decreases the power of the starting battery. If the hydraulic system has a pump with fixed teeth or lobes, this starting load may be seriously increased above normal.

Vickers Balanced Vane Type Pumps *start at practically no load.* At rest and at normal starting speeds, the sliding vanes are retracted . . . only after the engine fires do the vanes extend and pumping begins. As a result, cold weather starting is much easier when a Vickers Vane Type Pump is used.

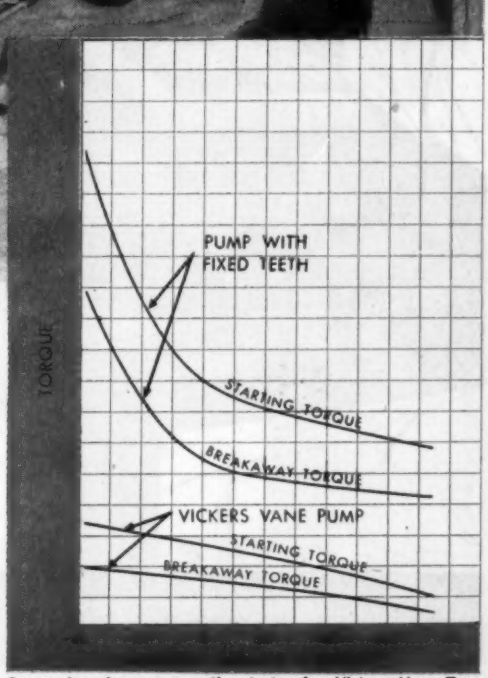
Get in touch with the nearest Vickers office for full information.



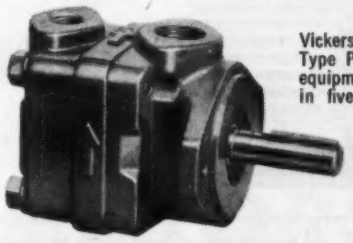
(Left) Schematic diagram of Vickers Balanced Vane Type Pump showing how sliding vanes are retracted at normal engine cranking speeds. No oil is pumped and there is practically no starting load.



(Right) Similar diagram of Vickers pump showing how pump vanes are extended when engine is running. Pumping then begins and continues at all engine speeds.



Curves based on comparative tests of a Vickers Vane Type Pump and an equal capacity pump with fixed teeth. Oil used in both was SAE 10W premium grade.



Vickers Balanced Vane Type Pumps for mobile equipment are available in five basic sizes, 15 normal delivery ratings and a variety of mountings. Ask for new Catalog M-5101.

6628

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Perhaps the Needle Bearing can solve your anti-friction problems. Our engineers will be glad to work them out with you.

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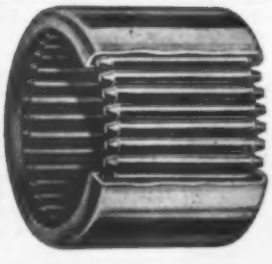
Torrington, Conn., South Bend 21, Ind.



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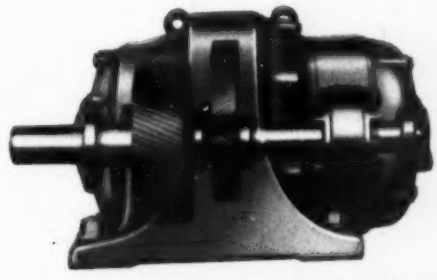
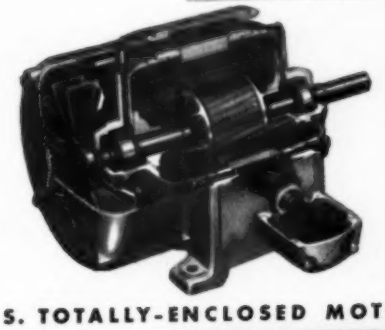
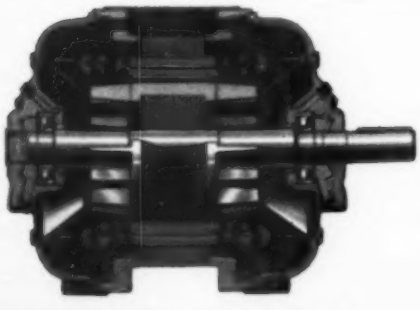


U. S. SYNCROGEAR MOTOR

U. S. VARIDRIVE MOTOR



U. S. TOTALLY-ENCLOSED MOTOR



U. S. UNICLOSED MOTOR

US MOTORS

THEY'VE MADE THEIR WAY BY THE WAY THEY'RE MADE

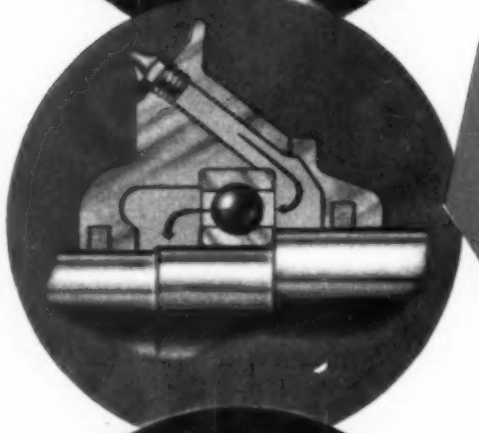
EXTRA FEATURES in U.S. MOTORS increase dependability

If extra long motor life interests you, look into U. S. Motors. Three major features give U. S. Motors years of extra life. (1) All windings are asbestos-protected because asbestos can never carbonize. The windings are forever safe against high temperatures. (2) Lubriflush lubrication insures bearing life far in excess of endurance of conventional types. You get life-time lubrication plus the convenience and durability of re-lubrication. (3) All castings are normalized to maintain accuracy of bearing settings.

Added features include centricast rotor, advanced styling, weatherproof design, highly hardened gears in Syncrogear types, and extra quiet operation. All add up to extreme dependability, unequalled in any other motors.

Extra life without extra cost

ASBESTOS PROTECTION



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A condensed catalog featuring all types of U. S. Motors in full color. Presents 19 types of motors.

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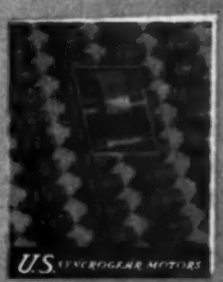
Totally-enclosed types meeting Underwriters' specifications. Latest improvements for hazardous services.



SYNCROGEAR
Internally-geared motors up to 30 h.p. Pyramidal design. Hardened gears. Sealed protection. 10 to 10,000 r.p.m.

SANITARY
Advanced design meeting all sanitary requirements. Immaculate. Baked white enamel finish. Rustproof.

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Los Angeles 54, Calif. (Box 2058) or Milford, Conn.

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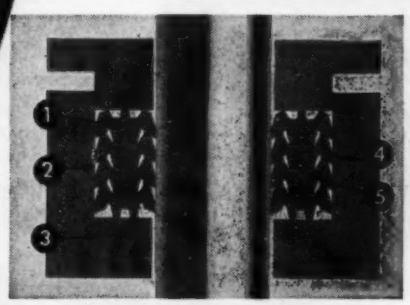

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1. Lips are positioned diametrically and vertically by center section of sealing ring.
2. Spaces between lips and heels allow fluid pressure to act upon each lip.
3. Lips are protected by the projecting portion of center section against damage by excessive gland pressure.
4. Lips are supported to prevent collapse or distortion by excessive fluid pressure.
5. Each ring correctly centers itself on the preceding ring so that they align vertically and nest perfectly.

Uneepac

...the new Johns-Manville automatic ring packing

EQUIPMENT DESIGNERS are finding that this newest Johns-Manville packing development enables them to hold stuffing-box sizes to a minimum . . . thereby save both space and machining.

This ability of Uneepac to provide high sealing efficiency in minimum packing depth results from the fact that each ring is a complete self-contained packing unit. Uneepac is designed so that the center section of each ring positions the lips and protects them from excessive gland pressure. Header and follower rings are therefore seldom required.

In addition, Uneepac offers other advantages that are important both to the designer and the user:

SIMPLIFIED INSTALLATION—Each Uneepac ring centers itself on the preceding ring so that the entire set is aligned vertically and nested perfectly. This feature practically insures trouble-free installation.

MORE EFFICIENT SEALING—Because it is designed so that each lip is always exposed to fluid pressure, Uneepac has excellent pressure sensitivity . . . is instantly responsive to fluid pressure changes.

REDUCED FRICTION AND WEAR—The operation of this new automatic packing is completely independent of gland pressure. This reduces friction to a minimum—saves wear on both rod and packing—and contributes to longer life with corresponding reductions in down time for replacements.

Uneepac is available in sizes from 5/8" inside diameter to 63" outside diameter. For complete information, write Johns-Manville, Box 60 N. Y. 16, N. Y.

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Johns-Manville PACKINGS & GASKETS

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4-Way Flanged Valves
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Rotary Pilot Valves
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■ **CYLINDERS** — Over 800 basic models — 1½" to 12" bore sizes — 150 P.S.I. air or 300, 2000 or 3000 P.S.I. oil hydraulic service — Wide choice of standard mountings — Available with male or female, standard or 2:1, single or double end piston rods — Adjustable stroke — With or without cushion and with many combinations of mountings — Single acting, collapsible or telescoping, large bore and other special cylinders to meet unusual requirements.

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■ **ACCESSORIES** — To complete the circuit—filters, gauges, pressure switches, welding flanges, heat exchangers, slip joints and other equipment.

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Please send me the New H-P-M Component Catalogs checked below:

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- ☐ #701—Cylinders—150 P.S.I. Air, 300 P.S.I. Oil
- ☐ #721—Cylinders—2000 P.S.I.
- ☐ #741—Cylinders—3000 P.S.I.
- ☐ #801—Valves—2000 P.S.I. Threaded
- ☐ #821—Valves—3000 P.S.I. Flange
- ☐ #841—Valves—3000 P.S.I. Gasket
- ☐ #901—Accessories
- ☐ #1001—H-P-M Engineering Manual

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THE HYDRAULIC PRESS MFG. CO.
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APPLIED HYDRAULICS

Trends IN THE FLUID POWER FIELD

Don't Let Hydraulic Oil Reach the Floor

There will be some machine design changes resulting from the $50,000,000 fire at the General Motors Livonia plant last August. Although the cause of the fire at Livonia was sparks from an oxyacetylene cutting torch igniting liquid in a drip trough, industrial management has been awakened to consider all possible fire hazards. One hazard is hydraulic oil leakage onto the shop floor. Recognizing that oil leakage could be the next cause of a disastrous fire, the automotive companies are taking further steps to keep oil off their floors. Builders of hydraulic machines are being requested to design "oil catch" troughs on the machines. If there must be oil leakage, it will be caught before it hits the floor.

Steel Extrusions: Parts Will Cost Less

A modified hydraulically powered aluminum press is now successfully extruding small alloy steel shapes. Extrusions of SAE 8630 steel were cut, drilled and installed on Lockheed military Constellations without further machining. The finished cost was less than one third the cost of parts previously made by machining. Harvey Machine Company worked out the necessary changes on the extrusion press. The hydraulic changes involved new valving to increase ram speed. This plus die design and lubricants are the keys to successful extrusion of steel parts. Firms including Babcock & Wilcox Co., National Tube Div., and Allegheny Ludlum Steel Corp. are now extruding steel tubing and alloy shapes.

Local Engineering Meetings: A Door to More Use of Fluid Power

"Why use oil hydraulics?" "What is the optimum pressure for operating hydraulic machines?" "How can we stop oil leakage?" These are basic questions asked by practicing engineers attending meetings sponsored by chapters of engineering societies. The interest in obtaining practical information about fluid power is emphasized by the attendance at several local meetings. In Cleveland, on October 5th, the Machine Design Division of the Cleveland Engineering Society held a session on "Hydraulics as Applied to Machinery." More than 150 men attended. At the September 22nd meeting of the Fluid Power Mechanisms Division of the Philadelphia Section of ASME, the subject was "The Abuse and use of Oil in Industrial Equipment." Nearly 200 men attended.

Automation and Fluid Power Circuits

The word "automation," as used currently, has at least two distinctive meanings. First, as used and popularized by the Ford Motor Company, automation means the automatic handling of materials and parts in and out of machines. Second, a somewhat more restrictive technical definition is that automation is the equipment for automatic control, particularly self-regulating control. Automation might more simply be defined as automatic control. Automatic control has become an essential part of modern equipment that will produce a greater volume at less unit cost. It is significant that the tremendous growth in the number of hydraulic and pneumatic circuits for the actuation and control of modern production and processing equipment has paralleled the automation trend. The fields in which automation has been most advanced are those in which fluid power circuits are most heavily represented. For example, the automotive industry, with perhaps the most highly automatic production equipment, uses standard and special machines that are estimated to be from 85 to 90 percent hydraulically operated.

To Avoid Fluid Line Troubles

DEPEND UPON THE HANSEN REPRESENTATIVE

H. U. ROGNESS
H. U. Rogness, Inc., Minneapolis
Offers many years of experience in servicing and specifying equipment for hydraulic and pneumatic lines in plants of manufacturers, foundries, food processors and other industrial firms.

ELLIS AKIN
Ellis Akin Engineering Co.
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Provides specialized engineering service on pneumatic and hydraulic lines in the Kansas, Nebraska, Western Iowa and Western Missouri area.

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Sturgis Equipment Co., St. Louis
Serves widely diversified group of industries on problems related to pneumatic and hydraulic equipment, including filters, regulators, lubricators and quick-connective couplings.

for the know-how you need... when you need it

When you need help—and need it in a hurry—it will really pay you to know the Hansen representative in your area. In dozens of plants, it's almost routine procedure to call him—either when actual troubles arise—or when fluid line circuits are being planned or altered.

From his years of experience with almost every type of hook-up, he can tell you what works—and why it does. Frequently he can make suggestions which will quickly clear up your difficulties.

Quick-connective couplings are, of course, his main business—but so are fluid line problems. Make use of his know-how—it's yours for the asking.

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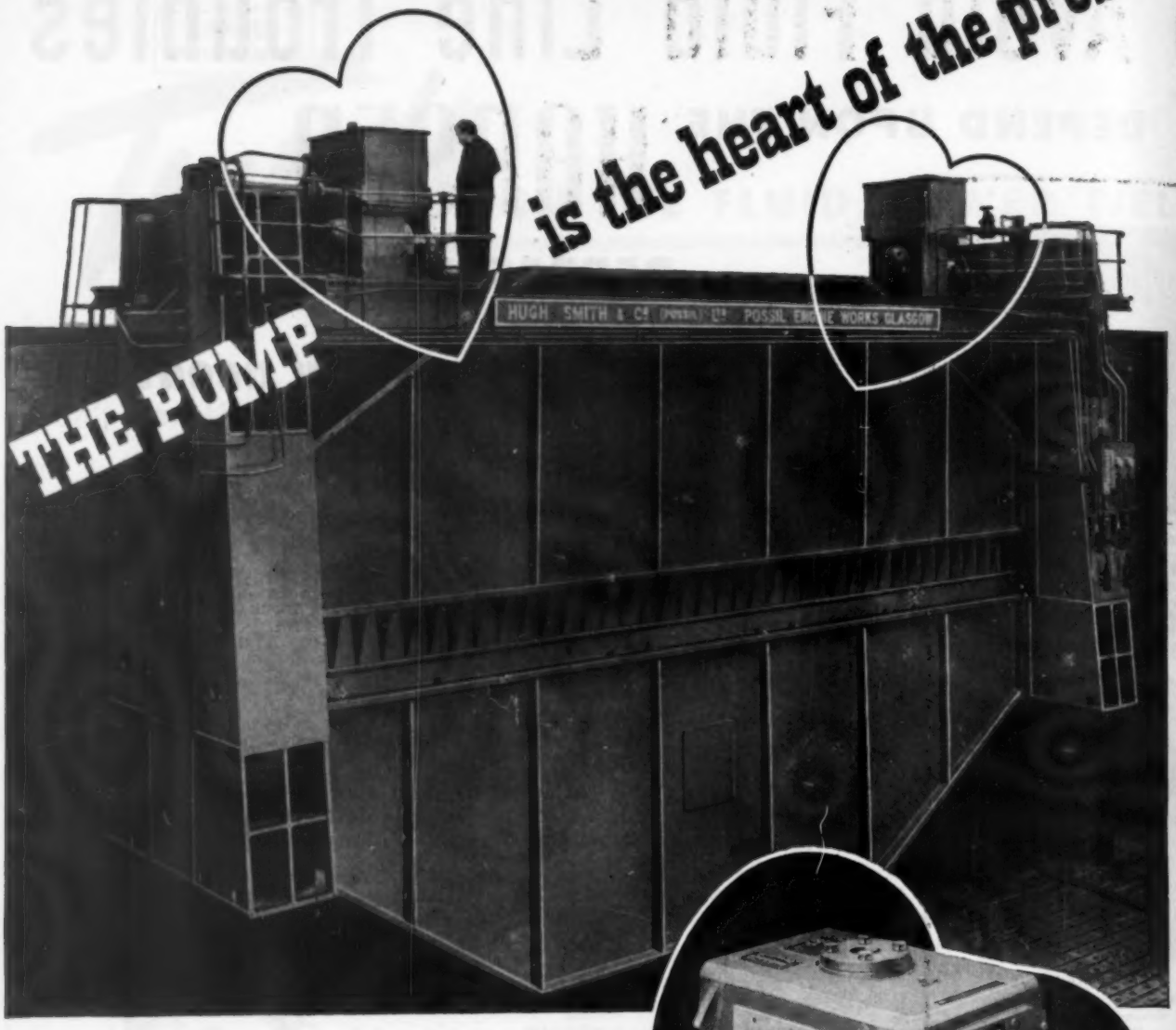
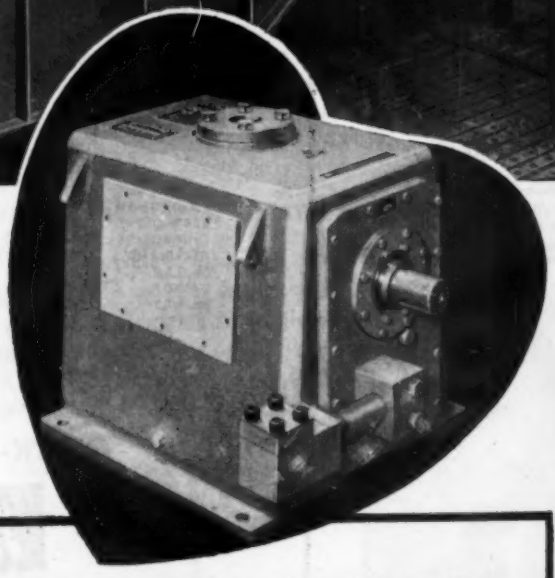
THE PUMP is the heart of the press . .





A 1,200-ton self-contained press by Hugh Smith & Co. (Possil), Ltd., designed for the manufacture of corrugated bulkheads for ships, and is also applicable to general flanging work in lengths up to 40ft.

This fine example of British press design incorporates "Electraulic" pumps and controls for :—

(*a*) Consistent and unfailing performance.
(*b*) Power output variable as required.
(*c*) Instantaneous response to finger tip control.
(*d*) Economy.
(*e*) Completely self-contained unit.

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HYDRAULIC PUMPS

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NEW ADVANCED DESIGN PROMISES TIGHTEST SEAL

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VIM LEATHER PACKING No. 1243-3

GET RESILIENCE NEVER BEFORE EQUALLED WITH A LEATHER PACKING!

SQUEEZE IT!

TIGHTLY CLOSED!

SPRINGS OPEN AS BEFORE!

Although Vim rubber-impregnated Packings No. 1243-3 are new in the field, they represent years of research and testing. Try them. Test them yourself. Your Houghton Man will gladly help you determine their efficiency for your particular applications. Further information can also be obtained from E. F. Houghton & Co., 303 W. Lehigh Avenue, Philadelphia 33, Pa.

Our new advances in packing design and fabrication mean superior service in both oil and pneumatic applications.

First of all, "Vim" Packings No. 1243-3 combine the best features of both synthetic rubber and leather. You get leather's long life and strength. You benefit through rubber's non-porous, heat-resistant qualities and its resiliency.

Moreover, our special molding process produces *thorough impregnation*—a thorough bond between rubber and leather—which promises you a number of advantages no other packing offers:

1. *Less friction,* through higher resiliency and lower "drag" of leather with cylinder walls.
2. *Longer use,* due to dense structure and high tensile strength of Vim leather.
3. *Easy installation*—and a much tighter seal—because of the exceptional pliability.
4. *Greater durability,* because compound has higher resistance to oils and solvents.
5. *Wide temperature range* (—65° up to 200° F.) and wide operating pressure (0 to 15,000 psi.).

VIM LEATHER PACKING NO. 1243-3
. . . a product of

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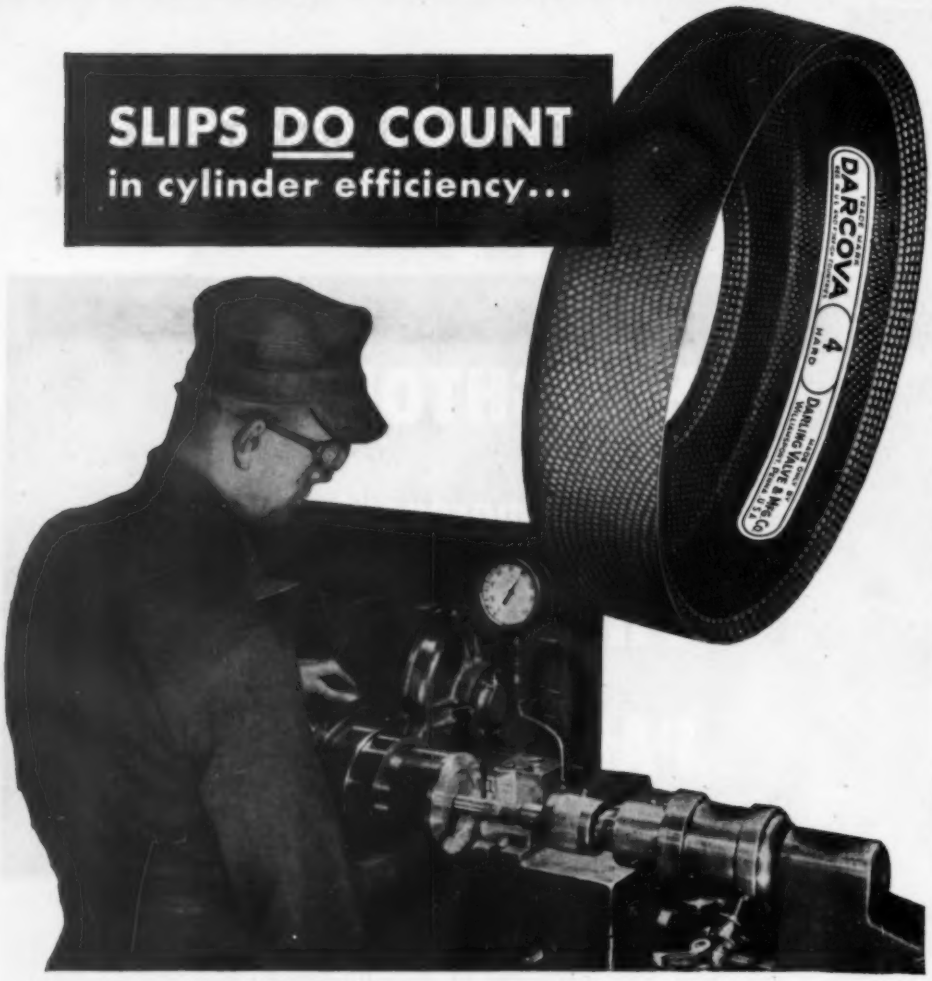
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

SLIPS DO COUNT
in cylinder efficiency...



Now, cost-conscious engineers are standardizing on **DARCOVA PUMCUPS!**

Reason—On all types of air and hydraulic controls and mechanisms maximum volumetric efficiency is assured with Darcova Pumcups. Moreover, Pumcups outlast ordinary packing at least 3 to 1!

CHECK THESE OTHER ADVANTAGES TOO!

- Reduced operating speeds
- Fewer shutdowns
- Smoother operation
- Lower power costs
- Longer cylinder life
- Closer control

If your slippage is showing, write for Bulletin No. 4502 on Darcova Pumcups for air and hydraulic mechanisms . . . or Bulletin No. 4401 on Pumcups for reciprocating pumps.

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP
PUMCUPS

LITERATURE AND SERVICES OFFERED IN THIS MONTH'S ADS

For more information circle numbers on the reader service card bound in this issue.

SOLENOID VALVES are described in Circular A prepared by Waterman Engineering Company. Design features, construction and sizes are included.

Circle 123 on Reader Service Card

FLEXIBLE HOSES for use in aircraft and industrial service are presented in a catalog for each of these two fields. Much useful information can be obtained from this literature by writing to Flex-O-Tube Div. of Meridan Corp.

Circle 32 on Reader Service Card

FLUID MOTORS are described in literature, Form No. 113-2, prepared by Sundstrand Machine Tool Co. It gives information on application, operation, performance, models and mounting arrangements.

Circle 109 on Reader Service Card

HYDRAULIC TUBING is described in a folder offered by Superior Tube Company. The literature gives the sizes, wall thicknesses and recommended maximum working pressures.

Circle 110 on Reader Service Card

AIR CYLINDERS are presented in a catalog available from Air-Mite Industrial Air Equipment, Inc. Information on air arbor presses and single and double acting air cylinders, is given.

Circle 5 on Reader Service Card

HOSE ASSEMBLIES for hydraulic use are covered in several catalogs supplied by Eastman Manufacturing Company. Catalog 102 presents hose couplings, Bulletin 231B straight adapter unions and Bulletin 232B angled adapter unions. Complete information is included.

Circle 28 on Reader Service Card

AIR CYLINDERS are described in Bulletin 8152 which is available from Tomkins-Johnson Co. Information is included on many standard sizes and styles.

Circle 112 on Reader Service Card

Continued on page 46

As a back-up Roll in a Plastic-to-Paper Coating Machine . . .

SILASTIC works ...where other materials fail!

Designed to test and demonstrate new techniques in coating paper with molten plastic, this 13" laboratory reverse roll-coater features a back-up roll covered with Silastic*, the Dow Corning silicone rubber. The Silastic is still in excellent condition after 600 hours of operation at temperatures in the range of 250 F and nip pressures as high as 50 pounds per lineal inch across the roll.

The elaborate cooling systems required when organic rubber rolls were used, are eliminated entirely. The heated roll preheats the paper, too, giving a better bond between the paper and the coating. If the web breaks, spilled plastic can be simply peeled off the Silastic, where organic rubber rolls had to be ground down.

Indications are that Silastic rolls may also prove useful in extrusion laminating coaters, as festooning rolls in curing ovens, and in other coating applications requiring resilience and easy release at high temperatures.

Silastic is also characterized by stability at temperatures far below the limits of any other kind of rubbery material, very low water absorption, good dielectric properties and high physical strength at high operating temperatures. Resistant to weathering, oxidation and to a variety of hot oils and chemicals, Silastic remains resilient long after organic rubbers stiffen or melt. When you need rubbery properties under severe operating conditions, ***Specify Silastic.***

*T.M.REG.U.S.PAT.OFF.

Mail this coupon TODAY for data on the properties of Silastic

DOW CORNING CORPORATION
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first in silicones

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Please send: ☐ List of Silastic Fabricators; ☐ Silastic Facts 10a; ☐ "What's a Silicone?"

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No Single Hydraulic Oil Fits All Operating Conditions Economically

That's why Sun makes a variety of oils to give top performance and economy in any system

The selection of the right hydraulic oil is determined by many factors, such as average operating temperature; rate of leakage; contamination caused by cutting fluid, water and dirt. *No single oil will meet all combinations of conditions economically.* It's sensible, therefore, to choose a hydraulic oil with care . . . to be sure that it will give top performance at lowest possible cost. Consult your local Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Department AP-11.

INDUSTRIAL PRODUCTS DEPARTMENT

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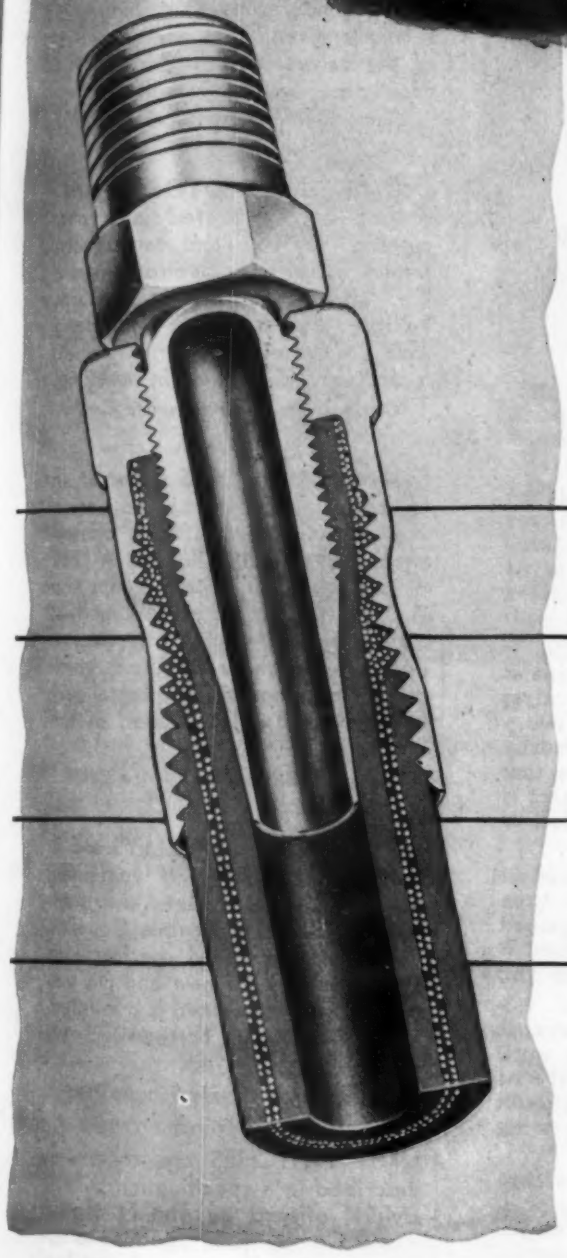
How to BEAT the high cost of HYDRAULIC BREAKDOWNS



make faster repairs with WEATHERHEAD REUSABLE COUPLINGS AND INDUSTRIAL HOSE

QUICK, EASY INSTALLATION!
Couplings go on in a hurry with only common bench tools.

LOWER COSTS!
Because couplings account for 75% of hose assembly costs, you'll realize major savings with Weatherhead Reusable Couplings; you can use them over and over again.

MINIMUM INVENTORY!
Make up any hose assembly you need, when you need it, from bulk stocks of hose and matching couplings.

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Extra gripping area on Weatherhead Couplings insures greater holding power; long-tapered dry seal pipe threads mean leakproof connections.

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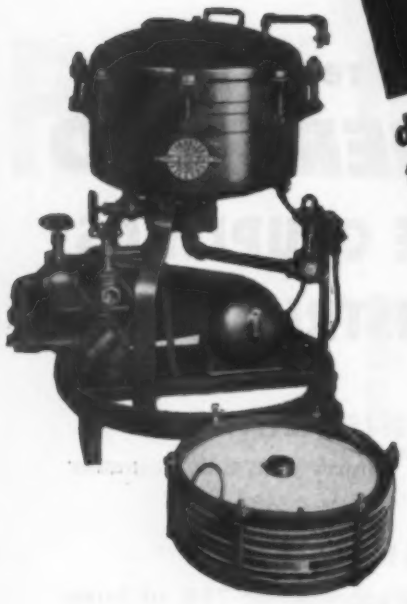
The Mark of Quality
WEATHERHEAD
FIRST IN HYDRAULIC CONNECTIONS

Keep your hydraulic oils, and coolants clean with . . .

SPARKLER FILTERS

designed specifically for this purpose. A practical protection for hydraulic machinery and cutting tools



The VR filter is designed for filtering hydraulic oil, quenching oils, transformer oil, solvents and other industrial liquids.

The Sumptype filter is ideal for filtering coolants. The filter plate assembly is attached to the intake pipe of the circulating pump and the coolant is drawn through the filter discs and delivered clean and free from all metal particles and grit, to the nozzels.

★ Clean hydraulic oil greatly prolongs the life of all moving parts, such as pistons, cylinders, pumps, valves, etc.

★ Filtering hydraulic oil extends the life of the oil. Drain and leakage oil may be reclaimed. One large user of hydraulic machinery saved $90,000.00 in hydraulic oil alone in one year by filtering oil with Sparkler Filters.

★ Filtering hydraulic oil eliminates sticking and clogging of valves and reduces down time and maintenance cost. A prominent authority on hydraulic machinery says that 70% of servicing and repairs is due to the improper condition of hydraulic oil.

★ Filtering coolant fluid removes all fine metal particles and grit from grinding wheels that is pumped back to nozzles unless a filter is employed in cleaning up the return coolant.

★ Clean filtered coolant prevents scratching and flat spots on work piece and increases the life of grinding wheels and cutting tools. Reduces the frequency of dressing grinding wheels.

The Sparkler VR filter is constructed on a simple filtering principle using filter paper as a media. The filter plates can be removed easily for cleaning which consists only of removing the dirty paper and replacing with fresh sheets. Any shopman can make this change of paper in a few minutes. The cost of replaced paper is less than a dollar per change.

Let a Sparkler representative demonstrate these filters in your plant

SPARKLER MANUFACTURING CO.
Mundelein, Ill.

Free Literature Offered in this Month's Ads

Continued

CONTROL VALVES are completely described in literature available from C. B. Hunt & Son, Inc. Information on single valves, lever operated single plunger valves and pilot cylinder operated hydraulic valves is given. Sizes and pressures of the valves for both air and hydraulic use, are also included.

Circle 54 on Reader Service Card

INDUSTRIAL MOTORS are described and illustrated in a new catalog No. 680, and can be obtained by writing Electro Dynamic Div. of General Dynamics Corp. Features and ratings are given along with complete information on dc motors and generators in their line.

Circle 29 on Reader Service Card

ROTARY AIR PUMPS either of an air cooled or water cooled design are presented in catalogs offered by Kraissl Co. Inc. Bulletin A-1289 describes the air cooled pumps and A-1523, the water cooled models. Other fluid power transmission equipment such as air filters, which can be furnished as an integral part of each pump, is included in the literature.

Circle 64 on Reader Service Card

VARIABLE SPEED PULLEYS are illustrated in a catalog containing complete technical data and is offered by Lovejoy Flexible Coupling Co. How increased performance and versatility for new and old machines can be obtained is presented. Sizes, ratios and horsepowers are given.

Circle 71 on Reader Service Card

LIMIT SWITCHES are completely described in a specification Bulletin EM-51, offered by The National Acme Company. In addition to engineering specifications, design features and applications are included.

Circle 76 on Reader Service Card

HYDRAULIC PUMPS are discussed in Catalog H-7 released by The Commercial Shearing and Stamping Company. Much interesting and useful material is incorporated in this catalog on this subject.

Circle 18 on Reader Service Card

Continued on page 50

$4556* SAVED on less than a $10 investment

PER YEAR

IT USED TO TAKE 3 MEN 10 MINUTES

NOW! one man 10 seconds!

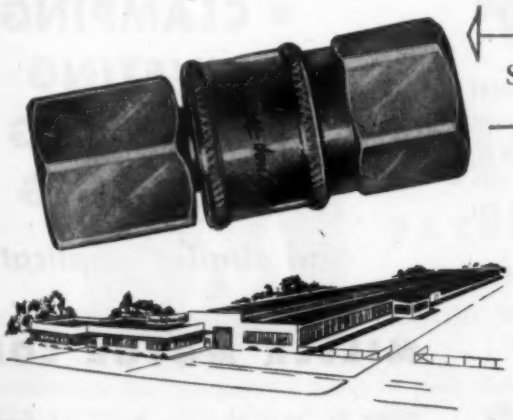
It used to take three men to change an air tool at the Warren Car Co., (Warren, Pa.) manufacturers of railroad gondola cars. It took one man to kink the air hose, another to hold the tool end, and a third to spin off one tool and spin on another. This was usually a ten-minute operation. More important, of the three men changing the tool, only one was a tool operator; one was a welder; and the other a reamer, which meant that they had to leave their jobs just to help the air tool operator change from a riveter to an impact wrench. Today, with a Snap-Tite "Hi Flow" coupling (under $10 investment), it is a one-man job—and it only takes ten seconds to change air tools resulting in a $4,556 savings in valuable production time.

* *Figures available on request.*

Here's how the coupling works: Just pull back the sleeve on the coupler and snap it off the tool (the built-in valve in the coupler automatically shuts off the air); snap the coupler on the next tool to be used and a full flow of air is automatically restored—no valves to turn, no wrenches to use, and no hose kinking!

For every application there is a Snap-Tite "Hi Flow" coupling. If you, in your production processes or maintenance operations, have pneumatic or hydraulic applications that require as little as once a year connect or disconnect—the use of Snap-Tite couplings can effect a considerable saving.

Available in sizes: ⅛" to 10" and up. They will handle air, water, gas—practically anything that flows. Snap-Tite couplings are made from steel (cadmium plated); or for special applications, they can be made of any machineable metal with any known plating.



Snap-Tite "Hi-Flow"
—the greatest flow in couplings!

Send for new Technical Catalog No. VP 83

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Miller

FLUID PRESSURE BOOSTERS

BOOST 80 PSI AIR

Input Range: 40 to 3000 psi Air or Fluid

TO 2000 PSI HYDRAULIC PRESSURE

Output Range: 200 to 10,000 psi Fluid

- Save space, weight and investment cost by replacing pump installations in many applications
- Less costly to install, operate and maintain
- **Hold pressure indefinitely** without the motion and heat generation of ordinary pump circuits
- Provide — at point of cylinder thrust — more efficient power with less weight in less space than direct driven air cylinders
- Save up to 95% of air consumed by direct driven air cylinders
- Operate at speeds of 30 to 450 strokes per minute

ESPECIALLY RECOMMENDED FOR

- **WELDING**
- **PUNCHING**
- **SHEARING**
- **CLAMPING**
- **RIVETING**
- **CRIMPING**
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and similar applications

FULL DETAILS IN MILLER BULLETIN B-200 SENT FREE ON REQUEST

Other Miller products include: Air cylinders, 1½"-to 20" Bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

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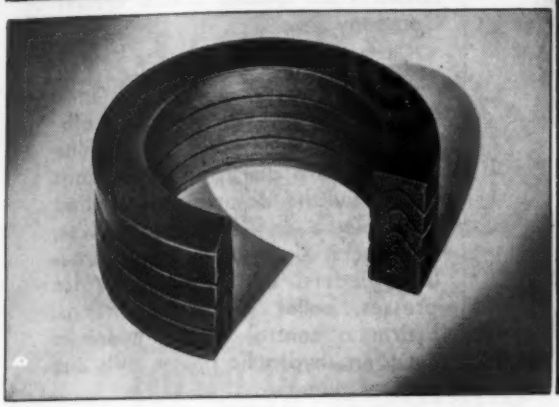
Miller

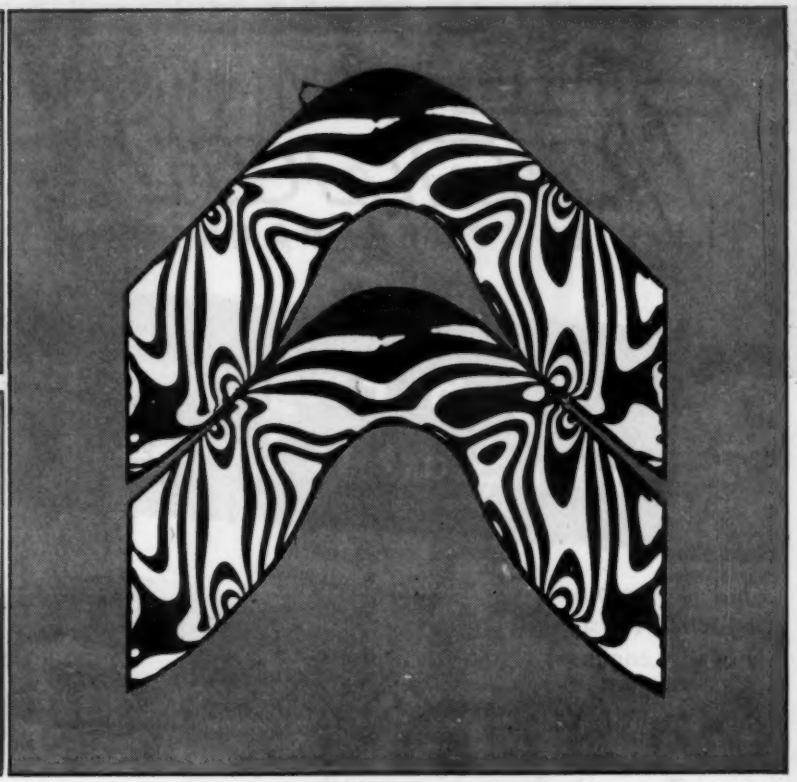
MILLER MOTOR COMPANY

2008 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

PHOTOELASTIC STRESS ANALYSIS OF VEE-FLEX® PACKING RING





Here's how R/M Vee-Flex Packing Rings automatically seal against pressure

R/M Vee-Flex Rings are widely used for packing pumps, valves, rams, presses, hydraulic cylinders, and other equipment. They are self-sealing and self-adjusting. Hydraulic pressure automatically expands the lip or circumference of the ring on the pressure stroke, forming a tight seal against stuffing-box wall and shaft. On the return stroke, the ring resumes normal position.

Shown above is one of a series of photoelastic stress analyses* made with the R/M Vee-Flex design.

Because Vee-Flex Rings have a convexly curved surface where they contact adjacent rings, a flexing action results which automatically produces a seal. Fringes in the photoelastic stress patterns show that the R/M Vee-Flex design distributes pressure laterally against the stuffing box wall and shaft, as well as longitudinally against the next ring.

Photoelastic analyses were corroborated by radial pressure tests* in which maximum sealing performance occurred at a point slightly below mid-width on the sealing area.

R/M Vee-Flex Rings provide a perfect seal, even when pumps or hydraulic cylinders are not in motion.

They nest together in sets, and the design brings full automatic expanding action to each of the nested rings. By increasing gland pressure, R/M Vee-Flex Rings continue to provide a reliable seal, even after wear has eliminated the automatic feature.

Vee-Flex Rings are made for practically all hydraulic and fluid-handling equipment up to 60" diameter. They are available in endless and split type rings.

Five types provide sealing against pressures up to and beyond 6000 psi for service against air, water, oil, steam, hydraulic, and other commercial fluids.

Write for R/M Vee-Flex Bulletin

**Performed at The Franklin Institute Laboratories for Research and Development.*

RM

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PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Crawfordsville, Ind.; Passaic, N.J.; Neenah, Wis.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Teflon Products • Asbestos Textiles • Industrial Rubber Products • Abrasive and Diamond Wheels Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Sintered Metal Products • Bowling Balls

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LEATHER PACKINGS

Job Engineered from Start to Finish

Just as a machine or tool designer starts building toward an objective—so do Rhoads engineers start to "custom-manufacture" Tannate Leather Packings. They are not ordinary packings—no sir! Like a custom-designed hydraulic press, Tannate leather packings are job-engineered from start to finish—*specially tanned, die-formed and "custom-impregnated" to accomplish definite objectives.* Detailed accuracy of finish is another "custom-line" feature in Tannate packings.

You get these advantages in Tannate Leather Packings: They have a low coefficient of friction; do not cold flow; will not score or abrade. They do not require lubrication, and they can be stored indefinitely without loss of tensile strength. Tannate packings are "custom-manufactured" to operate efficiently over a wide range of pressures and temperatures—from sub-zero to over 200° F.—and with different types of mediums.

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Free Literature Offered in this Month's Ads

Continued

"O" RINGS covered in a new Catalog No. OB-1152, tells the story of the "hydraulic packing package" that offers one source of supply for "O" rings and back-up rings for all military and commercial requirements. The catalog may be obtained from United States Gasket Company.

Circle 117 on Reader Service Card

CONTROL VALVES and many other products of Logansport Machine Co., Inc. are discussed in catalogs issued by the company. Literature available is on air control valves, air chucks, air cylinders, air-hydraulic cylinders, air and hydraulic presses, collet grip tube fittings, hydraulic control valves, hydraulic cylinders, hydraulic power units and coolant pumps.

Circle 70 on Reader Service Card

HYDRAULIC CONTROL SYSTEMS can be simplified, is the subject material in a new brochure offered by Almo Tool Co. Their method of channelling hydraulic fluids at high temperatures is described.

Circle 7 on Reader Service Card

HIGH PRESSUURE PUMPS, arbor presses and valves are products of Finney Presses, Ltd. which are described in literature now available.

Circle 31 on Reader Service Card

ROD WIPER which affords permanent protection from falling or flying debris is described in literature offered by Hydraulic Accessories Co. Protection is given to cylinder rods, machine spindles, guide or locating pins.

Circle 55 on Reader Service Card

ROLLER BEARINGS are covered in Technical Bulletin SF-6611 and is available from Roller Bearing Company of America.

Circle 96 on Reader Service Card

WATER-OIL SEPARATOR is covered in an Equipment Bulletin presented by Honan-Crane Corp. Complete information on installation and applications are included.

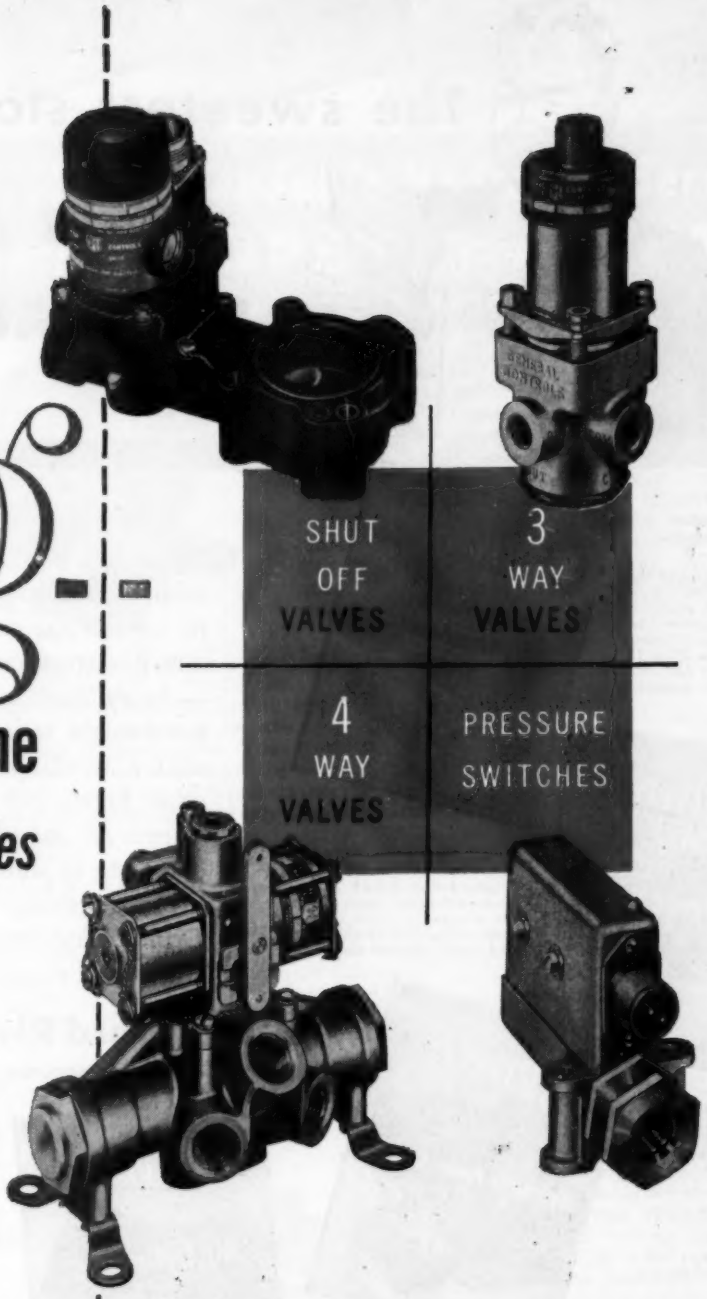
Circle 52 on Reader Service Card

Continued on page 53

hi-g

for any machine

that rolls, floats, or flies



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hi-g controls

In engineering terms "high g" means high gravitation forces. In performance terms "Hi-g" means General Controls' reliable line of automatic pressure, temperature, level and flow controls for heavy duty under acceleration factors from 10 to 300G. The Hi-g line comprises electromagnetic pilot and shutoff valves... manual and motor-driven gate valves... electrohydraulic selector valves... gauge and differential type limit controls... all light in weight, compact in design and trustworthy in operation... handling a great variety of liquids and gases in a wide temperature range.

For high efficiency performance under extreme vibration and acceleration conditions it's General Controls Hi-g Controls... the best in automatic control for any machine that rolls, floats or flies.

GENERAL CONTROLS

Glendale, California • Skokie, Illinois

Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls for Heating, Home Appliances, Refrigeration, Industrial and Aircraft Applications.

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The sweetest story ever told—

on AIR and HYDRAULIC POWER!

Rivett Hydraulic Cylinder Catalog Section 106 —
Details: Cushioned and non-cushioned, standard rod and 2:1 over-size rod, single and double end rod, internal and external threads, all standard mountings in 2" to 10" bores. Offered for 1500 P.S.I. 3000 P.S.I. available.

Rivett Hydraulic Valve Catalog Section 204 —
Details: 4-way, 3-way, pilot, and remote valves in 6 types of operation, 4 types of action, 7 sizes, 5 piston designs. Offered for 1500 P.S.I. 3000 P.S.I. in most models.

These five books, totaling 68 pages, are jam-packed with all the important and necessary data required to lay out successful air and hydraulic circuits. Over 400 Rivett models, in a variety of sizes, are detailed — every standard air and hydraulic component offered in the industry. Description of each model includes working drawings, specifications, and cut-away views. All data pertaining to each model is shown on one page to facilitate layout. Easy to use, complete in information, these Rivett catalogs are a must on every board. Write to Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass.

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—All the necessary components for any efficient circuit.

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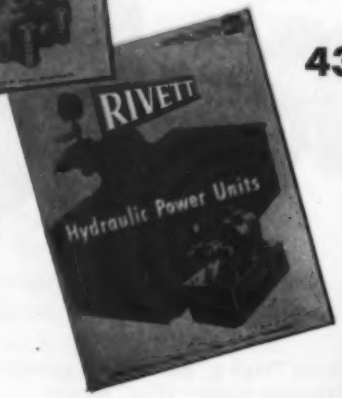

Rivett Air Cylinder Catalog Section 55—
Details: Cushioned and non-cushioned, single and double end rods, internal and external threads, 7 standard mountings in 1½" to 12" bores. Offered for 150 P.S.I. air and 300 P.S.I. oil services.

Rivett Air Valve Catalog Section 303—
Details: 4-way and 3-way, pilot and remote valves in 5 types of operation and in 5 sizes. Offered for 150 P.S.I. service.

Rivett Lathe & Grinder, Inc., Dept. AH-11, Brighton 35, Boston, Mass. Please send me: ☐ Hydraulic Cylinder Catalog 106 ☐ Hydraulic Valve Catalog 204 ☐ Hydraulic Power Unit Catalog 400 ☐ Air Cylinder Catalog 55 ☐ Air Valve Catalog 303

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BRONZE PUMPS are described in the 1953 edition of Oberdorfer Industrial Pump catalog. Various types such as heavy duty, close coupled, high volume and rubber impeller are presented. This literature may be obtained from Oberdorfer Foundries.

Circle 78 on Reader Service Card

SOLENOID VALVES are described in a booklet, "The Valcor Solenoid Valve with the Floating Shear Seal", and is offered by Valcor Engineering Corp. Features and specifications are included.

Circle 119 on Reader Service Card

AIR AND HYDRAULIC CYLINDERS are described in Bulletin #731, "Lindberg Air Cylinders" and in Bulletin #701, "Lindberg Hydraulic Cylinders." Complete information on installations are included. The catalogs are available from the Lindberg Engineering Company.

Circle 68 on Reader Service Card

HYDRAULIC CYLINDERS are presented in Catalog No. 103 offered by S-P Mfg. Corp. Models, sizes and pressures are covered. Catalog No. 102 presents the range of models and sizes of their air cylinder line.

Circle 102 on Reader Service Card

AIR HYDRAULIC PUMPS are presented in a catalog offered by Powermatic Inc. Interesting and useful information is included.

Circle 88 on Reader Service Card

BOOST PUMPS, manufactured by Sprague Engineering and Sales Corp. can boost air from 100 psi to 10000 psi fluid pressure. Models and applications are outlined in a bulletin prepared by the company.

Circle 105 on Reader Service Card

REMOTE CONTROLS, hydraulically operated are described in literature offered by Sperry Products Inc. Complete information as to features and applications are included.

Circle 104 on Reader Service Card

Continued on page 58

LIFT LOWER PUSH PULL

...for Dependable Hydraulic Service, install ROPER *Rotary* PUMPS

PRESSURES TO 1000 P.S.I.

Roper *dependable* Pumps! Smooth running units that add to the efficiency of diversified hydraulic applications. The Roper principle of only two moving parts—equal size pumping gears operating in a sturdy case with proper clearance—results in superior serviceability and promotes long life. The Roper Pumps illustrated are representative of standard pumps suitable for most installations. For unusual applications, let Roper engineers work with your design engineers in developing a special Roper to fit your needs.

SERIES H . . . Pressures to 1000 P.S.I.—Capacities 10 to 75 G.P.M. Spur gears operate in axial hydraulic balance . . . roller bearings and bronze wear plates reduce friction under heavy loads . . . splined drive shaft absorbs thrust loads. Most models can be direct connected, belt, or gear driven. Packed box or mechanical seal.

SERIES K . . . Pressures to 150 P.S.I.—Capacities ¾ to 50 G.P.M. Compact, yet sturdy enough to handle a wide range of jobs. Self-lubricated by liquid being pumped . . . handle total suction lifts up to 25 feet . . . come equipped with mechanical seal or packed box, with or without relief valve. Easy to install and apply.

SEE OUR CATALOG IN SWEET'S

SERIES F... Pressures to 300 P.S.I.—Capacities 1 to 300 G.P.M. Popular pumps that feature 4-port design (eight optional piping arrangements, 4 for clockwise and 4 for counter-clockwise rotation.) Supplied in standard or stainless steel fitted models to suit specific needs. Furnished with or without relief valve, with mechanical seal or packed box. Ideal for hydraulic power generation in a wide range of applications.

ROPER *Rotary Pumps*

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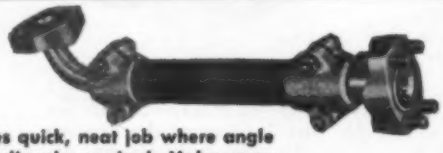
Get Fluid Power Transmission at its best.

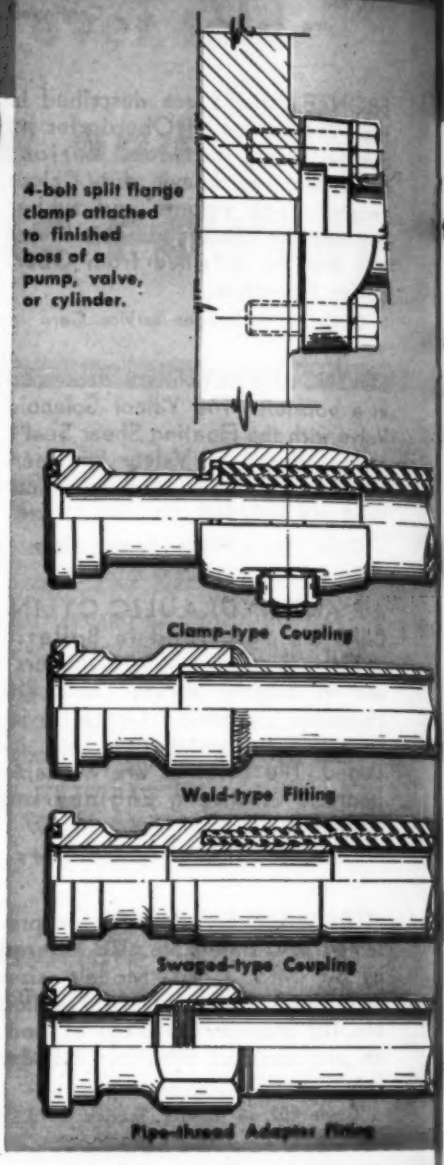
Revolutionary Split-flange clamp eliminates threaded joints, provides perfect seal

Anchor's new split-flange clamp is unusually versatile. It's SAE approved — you'll find it listed in the 1952 SAE handbook. Available for use with clamp-type hose coupling for production or emergency field service, permanently attached swaged-type coupling, weld-type fitting for steel tubing and iron pipe, and rigid pipe thread adapter fittings. Its flexibility lets you connect hose to tubing to pipe or any combination of these — simplifies assembly on all kinds of jobs. Here's why:

- ☆ Easy to assemble with small automotive-type wrench
- ☆ Ideal where clearances are limited
- ☆ Leak-proof — utilizes the "O" ring seal
- ☆ Reusable — can be used over and over
- ☆ Eliminates stresses and strains caused by wedging action of pipe threads
- ☆ A size and type for every application — ½" ID to 2½" ID



Does quick, neat job where angle coupling is required. Makes your job easier with plenty of wrench and bolt clearance. Full range of angles available.


4-bolt split flange clamp attached to finished boss of a pump, valve, or cylinder.
Clamp-type Coupling
Weld-type Fitting
Swaged-type Coupling
Pipe-thread Adapter Fitting

Exclusive Anchor Ductile sleeve hose couplings for extra safety, extra dependability

- ☆ Designed for high pressure wire braid hose
- ☆ Exclusive grip virtually makes coupling part of reinforcing wire of hose
- ☆ No leakage—no blow-offs, even under extreme pressures
- ☆ Factory assembled
- ☆ Made of steel for strength and maximum capacity
- ☆ Milled hex coupling body for compactness
- ☆ Provides positive seal of the synthetic inner tube of the hose

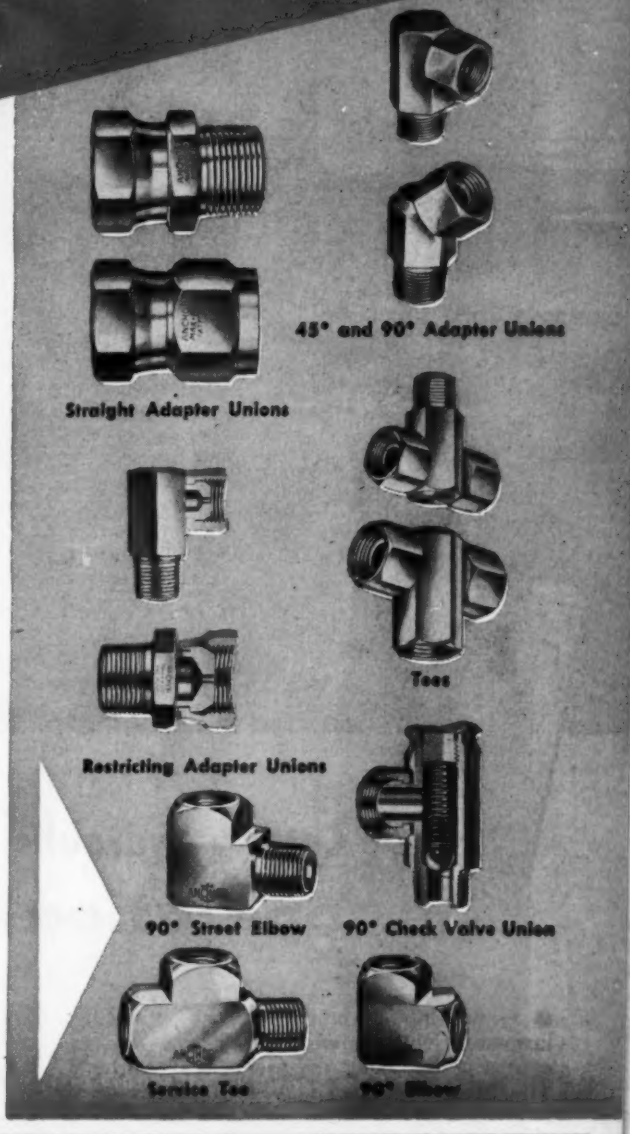
Anchor clamp-type reusable couplings offer quick easy assembly, powerful grip without special tools

- ☆ Designed for one- or two-braid high-pressure hose
- ☆ Two automotive type wrenches only tools needed to apply coupling to hose
- ☆ Reusable — plated to prevent rust
- ☆ No need to strip hose cover
- ☆ Couplings accomodate a range of hose types other than wire braid — reduces coupling inventory
- ☆ Compact design makes neat appearance

with ANCHOR hose assemblies and fittings

Select the components that fit your needs from the most complete line available

Specify Anchor for hose assemblies that can really take it — that can handle high, medium, or low pressure (or suction) day-in, day-out. Anchor's line of hose, couplings, fittings, and assemblies — the most complete available anywhere — offers you real design flexibility. You get the unit that fits your service requirements exactly. Look over the wide variety of Anchor hose assemblies and fittings — then mail the coupon for more detailed information.



Anchor adapter unions and pipe fittings are neat, efficient — simplify piping jobs

Only a few of the many types and sizes are shown

- ☆ Unions prevent hose strains during assembly
- ☆ Each union eliminates one or more pipe threaded joints
- ☆ Provides easy assembly in confined spaces
- ☆ Unions designed for extra strength. — give you dependable connection
- ☆ Pipe fittings handle pressure up to 3500 psi.

Anchor one-wire assemblies end leaks, blow-offs in medium and low pressure service

- ☆ Factory assembled to your specifications
- ☆ Positive grip assured by internal thread of coupling shell
- ☆ Couplings are neat and compact
- ☆ Available with swivel male or female nuts
- ☆ Leakproof

Anchor Reusable couplings for type QW hose reduce down time, let you make immediate repairs in rugged field service

- ☆ Only tools required to attach couplings and hose are vise, oil can, and wrench
- ☆ Repairs made immediately on job—less down time
- ☆ Couplings easily detached and reusable
- ☆ Minimum inventories required in hose lengths
- ☆ Leak-and blow-off proof
- ☆ Ideal for many types of service — oil, air, water, hydraulic fluid, LPG, refrigerants, fuel oil, and many others

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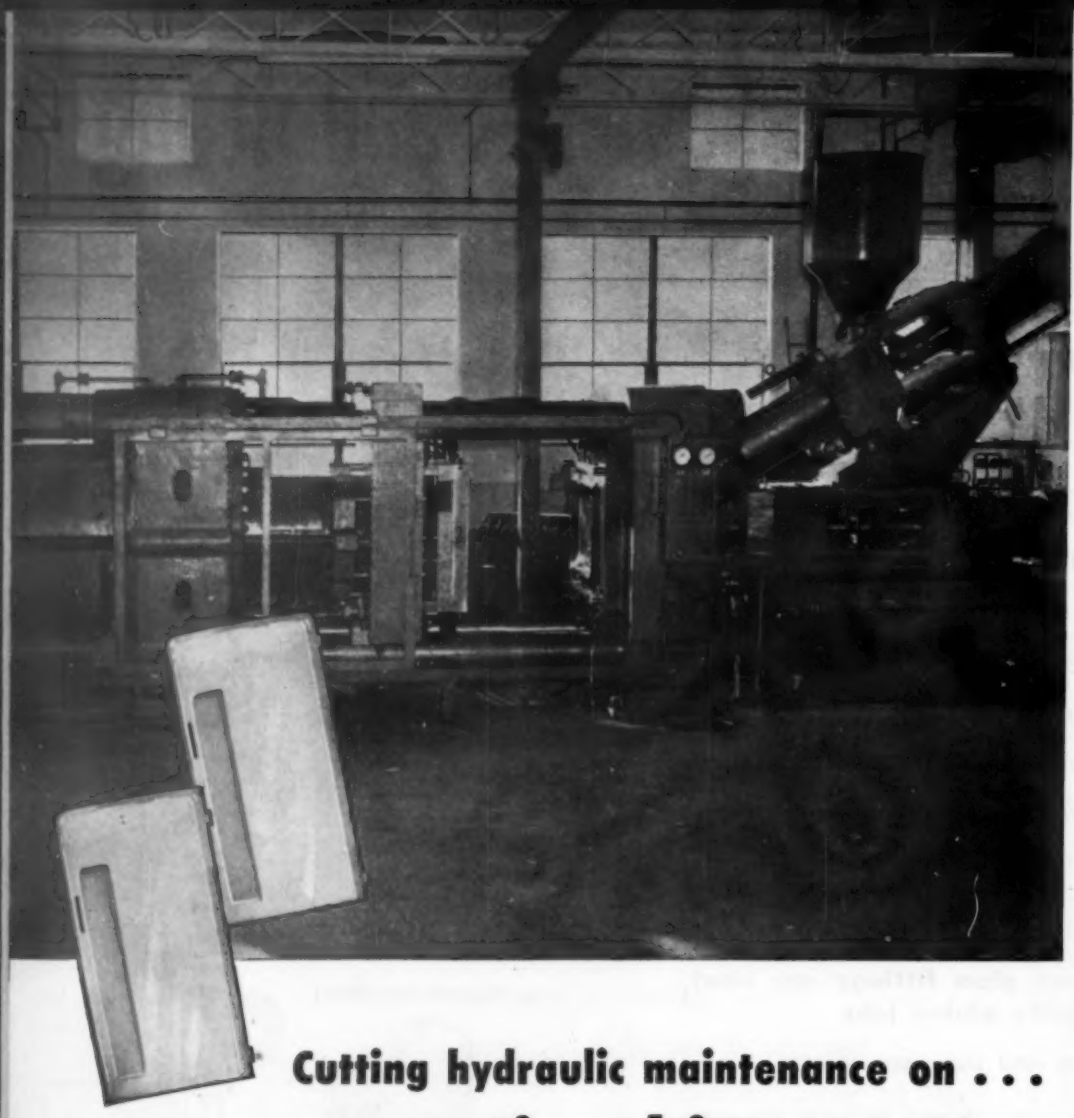

Cutting hydraulic maintenance on . . .

operation big squeeze

● Shown above is one of the world's largest injection molding machines, recently installed by the General Machine Tool and Die Company, Walled Lake, Michigan. The machine has a 1500-ton clamp, a plasticizing capacity of more than 300 pounds of material per hour, and can accommodate molds as large as 4 x 6 ft. in size.

The General Machine Tool and Die Company, pioneer of the injection molding process of plastic forming, uses the new giant injection machine to produce refrigerator door panels. Forming one entire panel per injection, this Operation "Big Squeeze" pioneers another important advance in injection molding.

In the hydraulic system of this great machine, as in ten other injection presses operated by the General Machine Tool and Die Company, STANOIL Industrial Oil has played a significant role. Withstanding severe conditions of heat and pressure, STANOIL has kept hydraulic systems clean and permitted efficient operation of units at all times. Maintenance has been kept to a minimum.

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Industrial Oil

Find how STANOIL can benefit you by discussing this multi-purpose oil with the Standard Oil lubrication specialist serving your section of the Midwest. Phone your local Standard Oil office. Or, write: Standard Oil Company, 910 South Michigan Ave., Chicago 80, Ill.

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See what STANOIL offers you...

You'll find the means to significant savings in this booklet. It describes the important qualities of STANOIL Industrial Oil and the resultant benefits which have made this multi-purpose oil the choice of midwest manufacturers for a host of lubricating jobs. Discover how STANOIL will give you superior protection through its unique combination of six outstanding characteristics, including high stability and effective rust prevention. Find how STANOIL can simplify stock, storage, and inventory in your plant by replacing special-purpose oils in a wide variety of equipment. Ask the Standard lubrication specialist from your nearby Standard Oil office for this booklet, or write: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

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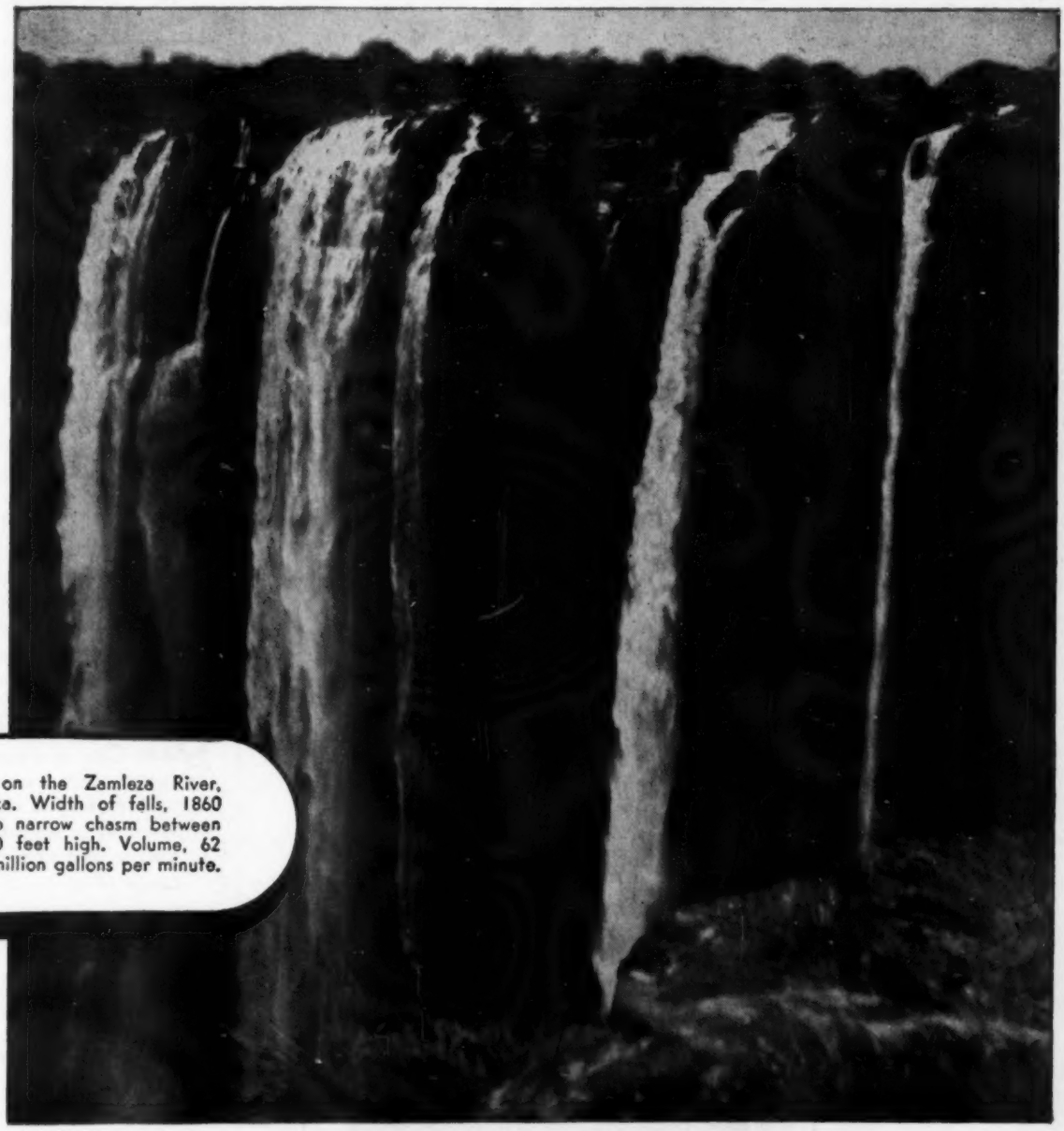
STANDARD *(Indiana)*

LOGAN FLUID POWER • DURABLE, DEPENDABLE SINCE 1916



Victoria Falls on the Zamleza River, Rhodesia, Africa. Width of falls, 1860 feet. Spills into narrow chasm between sheer walls 400 feet high. Volume, 62 million to 100 million gallons per minute.

LOGAN HYDRAULIC CONTROL VALVES

Illustrated, Model 4095—4-way, 2-position valve for directing pressure alternately to ends of double-acting hydraulic cylinder.

A broad range of types and sizes to most effectively meet any requirement—Design Engineers, Machine Operators, Maintenance Men appreciate these Logan advantages

- LONG-LIFE CONSTRUCTION
- EASY TO SERVICE
- INFREQUENT MAINTENANCE
- EASE OF INSTALLATION
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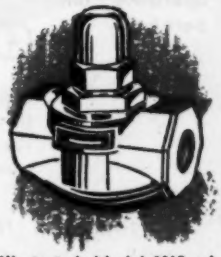
Let Logan Engineers help you design your Air and Hydraulic Circuits



Illustrated, Model 8015 adjustable speed control valve. Install between operating valve and one end of cylinder to meter flow of oil in one direction with free flow on return.

LOGAN MANUFACTURES 6,975 STANDARD CATALOGED ITEMS

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AIR CONTROL VALVES, Cat. 100-4 • AIR CHUCKS, Cat. 70-1 • AIR CYLINDERS, Cat. 100-1 • AIR-DRAULIC CYLINDERS, Cat. 100-3
AIR and HYDRAULIC PRESSES, Cat. 51 • COLLET GRIP TUBE FITTINGS, Cat. 200-5 • HYDRAULIC CONTROL VALVES, Cat. 200-4
HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 • HYDRAULIC POWER UNITS, Cat. 200-1 • SURE-FLOW COOLANT PUMPS, Cat. 62

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LOGANSPORT MACHINE CO., INC., 832 CENTER AVE., LOGANSPORT, IND.

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FIVE WAYS 5

PITCHLIGN
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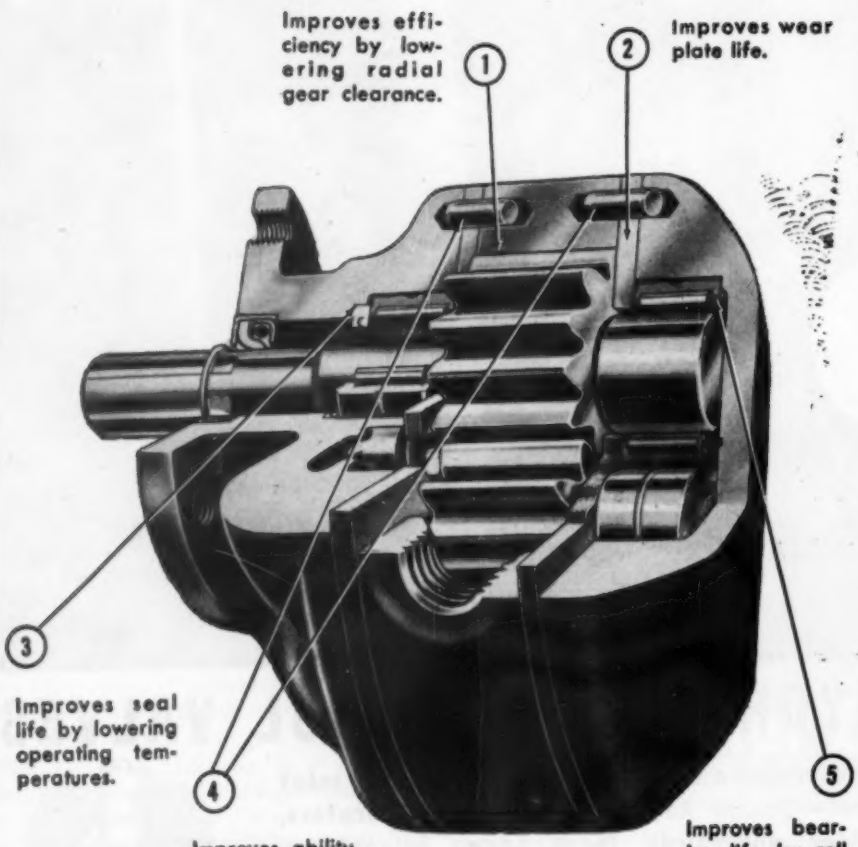
BEARINGS

Improve GEAR PUMPS



Improves efficiency by lowering radial gear clearance.

Improves wear plate life.

Improves seal life by lowering operating temperatures.

Improves ability to operate with normal misalignment.

Improves bearing life by roll control at the pitch line.

Pitchlign is the only small diameter bearing with rollers guided at their pitch line by a cage supported on outboard flanges of the race.

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RBC

ROLLER BEARING COMPANY OF AMERICA
Sullivan Way, West Trenton, New Jersey

Free Literature Offered in this Month's Ads

Continued

QUICK COUPLERS are described in literature available from Ulrich Mfg. Co. Complete outline of models and sizes in standard and breakaway types, is included.

Circle 115 on Reader Service Card

AIRCRAFT EQUIPMENT and facilities are presented in a new descriptive brochure containing detailed information on Adel Division of General Metals Corp. line of equipment.

Circle 2 on Reader Service Card

SLIDE-SEAL COUPLINGS are presented in descriptive literature available from Aeroquip Corporation. Design and construction features are outlined and various applications are suggested.

Circle 3 on Reader Service Card

AIR MOTOR manufactured by The Bellows Co., is described in a new 36 page, three color booklet. The complete story is told on bore sizes, stroke lengths and many other items of design and application.

Circle 14 on Reader Service Card

HYDROLUBES are hydraulic fluids that contain water for non-flammability. The entire subject is discussed in a booklet "Ucon Hydrolubes", F-7380, prepared by Carbide and Carbon Chemicals Company.

Circle 16 on Reader Service Card

CARTRIDGE PUMPS as manufactured by Pesco Products Division of Borg-Warner Corp. are made in varying sizes and pressures. Complete design specifications and performance chart is available from the company.

Circle 85 on Reader Service Card

PACKING RINGS are described in R/M Vee-Flex bulletin which gives complete data and table of sizes. Available from Raybestos-Manhattan, Inc.

Circle 91 on Reader Service Card

RELIEF VALVES, manufactured by Fluid Controls, Inc., are described in literature made available by the company. Data and specifications are included.

Circle 33 on Reader Service Card

Continued on page 60

Circle 96 on Reader Service Card

Circle 68 on Reader Service Card

BIG CYLINDERS

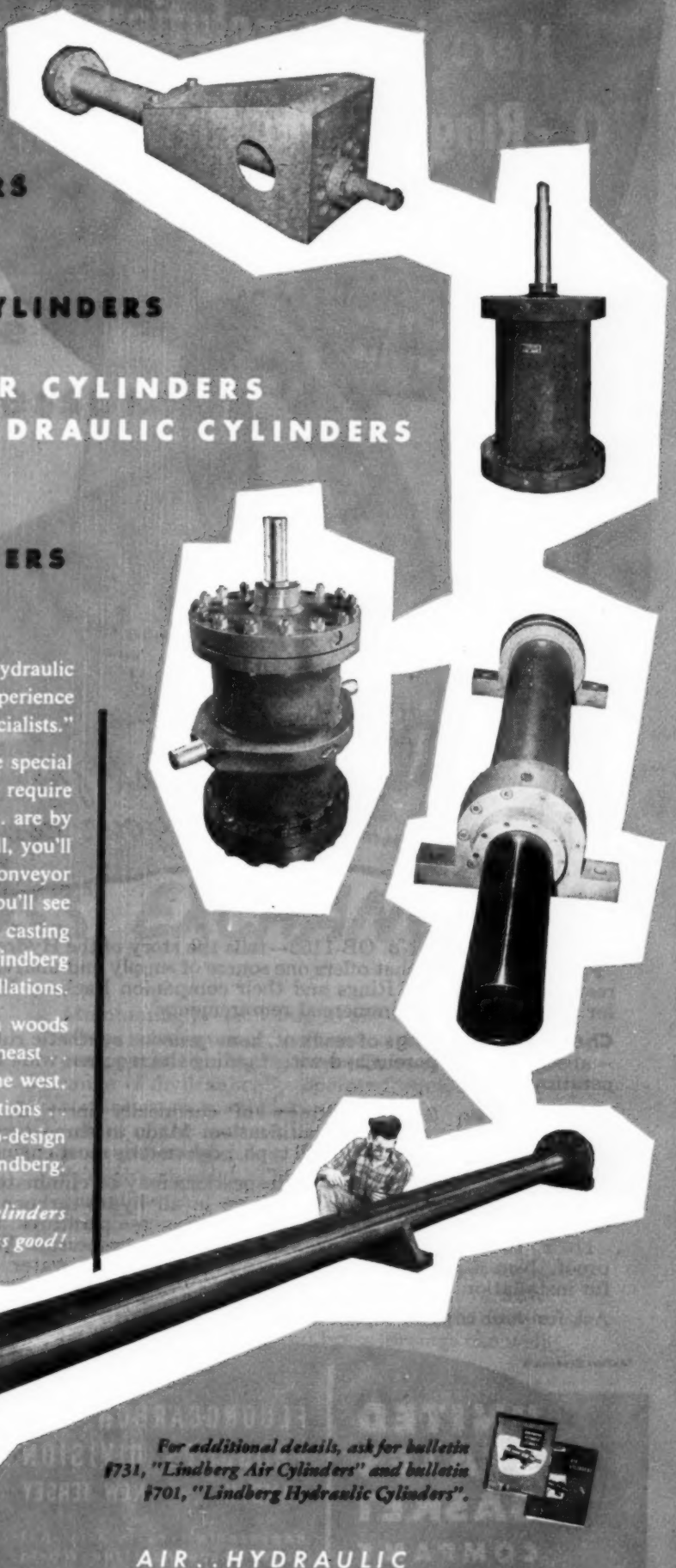
LITTLE CYLINDERS

SPECIAL CYLINDERS

LINDBERG AIR CYLINDERS HYDRAULIC CYLINDERS

SHORT CYLINDERS

LONG CYLINDERS



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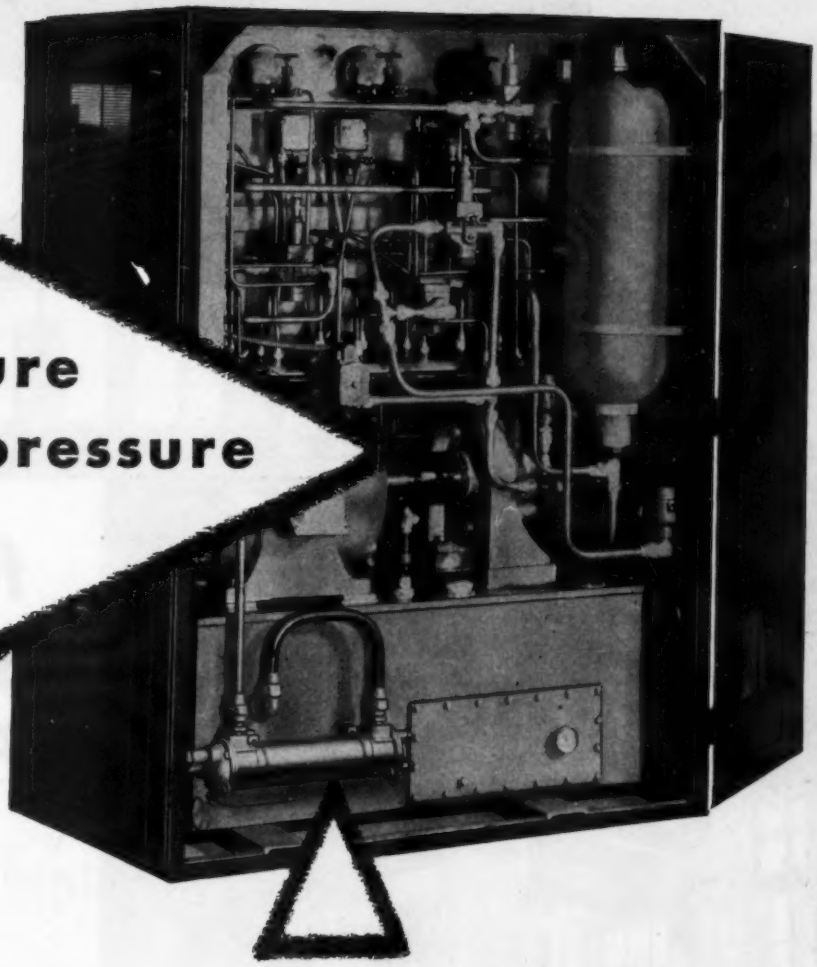

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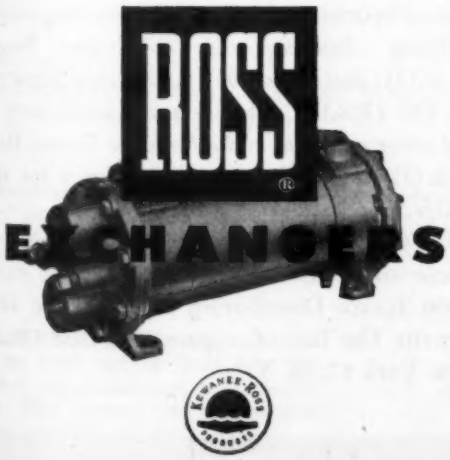

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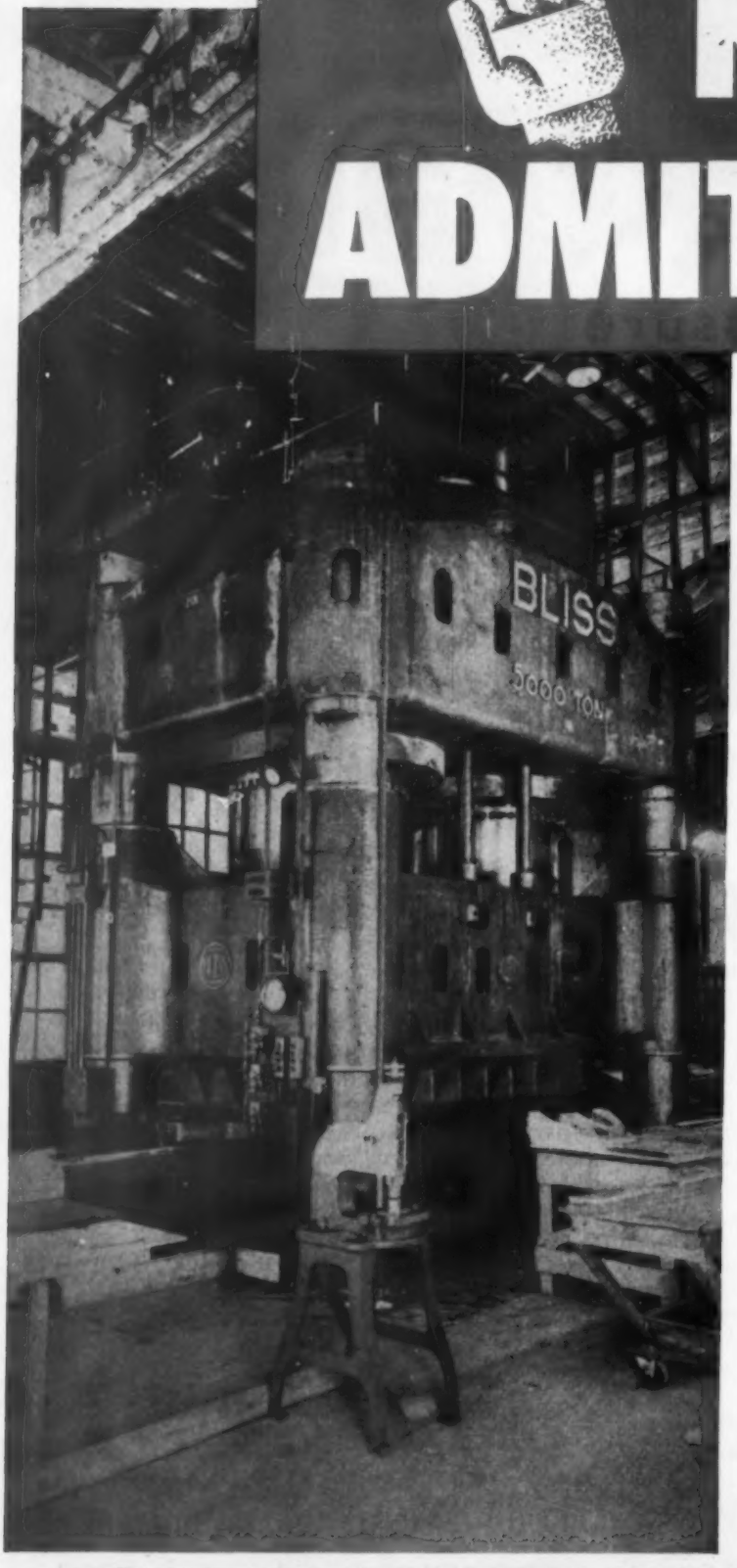

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FOR ALL HYDRAULIC UNITS

Names of prize winners in the 1953 Prize Paper Contest were published in October. Four prize articles are included in this issue.

How AIR POWER

Solves a Motor Assembly Problem

By Thomas Baxter and Charles G. Spicer

AFTER the laminations of a motor rotor have been stacked with the required skew, and the shaft inserted, copper bars have to be placed in the holes around the periphery, Figure 1. Mechanical machines which were modified shapers have been doing this work.

About two years ago, it became necessary to make an additional machine, but no shapers were available so an air operated machine was designed and built. This was a vertical machine, and the copper wire (.140" dia.), as it came from the reel, was passed over a pulley at the top of the machine, through a straightener, then through the gripper attached to the main cylinder and into the rotor. Knives, pneumatically operated, cut the wire and immediately afterwards the rotor indexed one hole ready for the next

THOMAS BAXTER, CHARLES G. SPICER, Tool Department, Leland Electric Canada Ltd., Guelph, Ontario.

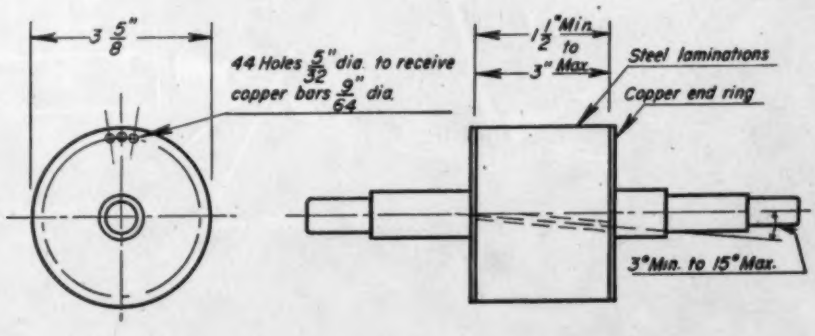


FIG. 1. THE JOB; Tooling was designed to feed copper bars into rotors used on fractional horsepower motors. The rotors vary in length and the amount of skew varies.

length of wire. This process repeated until the rotor was completed when the machine stopped.

The table on this machine was adjustable for different skew angles and it meant, by the nature of its construction that realignment was necessary for every change in skew angle. It was found by experiment with this first machine that as long as the copper wire was aligned properly with the entrance to the hole it did not matter at what angle the wire was fed. Consequently, on the second machine, described in detail here, the table was made non-adjustable at an arbitrary angle of 10 degrees and by feeding the wire in at the same end of the rotor as the indexing is done, the entrance of the hole is always in alignment with the incoming copper wire.

General Description

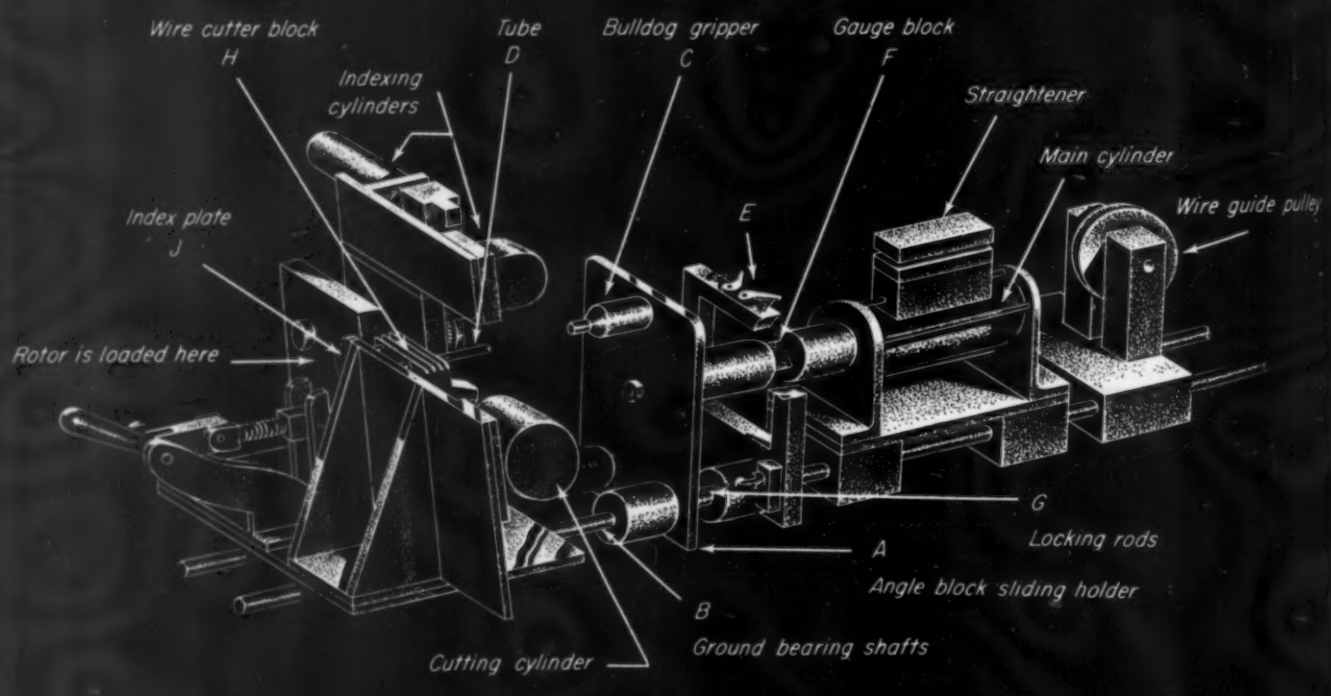
The machine shown in Figure 2 performs the operation by straightening the wire as it comes from the reel, inserting it in the rotor to the required length, cutting off the wire and indexing the rotor a hole at a time, until the rotor is completed.

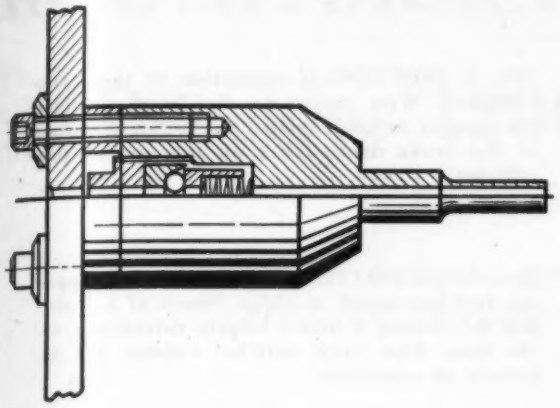
An angle block sliding holder "A" is equipped with round bearing blocks fitted with bronze bushings or bearings. This block moves back and forth horizontally on two ground bearing shafts "B" 1⅜ inches diameter. On the forward stroke a bulldog gripper "C" (see also Figure 3) takes hold of the wire and under the influence of the main cylinder pushes it through a tube "D" whose bore is a free fit for the copper rod throughout its entire length. This tube prevents the wire from buckling or bending. After passing through this tube the wire emerges through the index plate and into the rotor. When the main cylinder has reached the end of its stroke the wire has been inserted into the rotor to the required distance and pneumatically operated cutters on block "H" cut off the wire (Figure 4).

As soon as the wire is cut off the rotor indexes one hole and the main cylinder returns. On the return stroke, the gripper "C" releases the wire and another gripper "E" of the open type prevents the wire from slipping back with the plate "A". When the main cylinder has returned it trips a switch and immediately moves forward again and so the process repeats until when the last hole is reached a projection on the index plate trips a switch which prevents the main cylinder from operating on its forward stroke.

The different lengths of wire required to suit the various rotor lengths are obtained by the use of horseshoe gauge blocks "F" which are placed on the piston rod of the main cylinder and control the length of the return stroke. Working in conjunction with these blocks are a set of quick locking rods "G". These

FIG. 2. THE MACHINE: Copper wire fed in over the pulley goes through straighteners, grippers, through a tube into the rotor. Once the rotor is clamped in place the entire operation is automatic. Wire is fed to the proper length by movement of the sliding holder which is powered by the main cylinder.





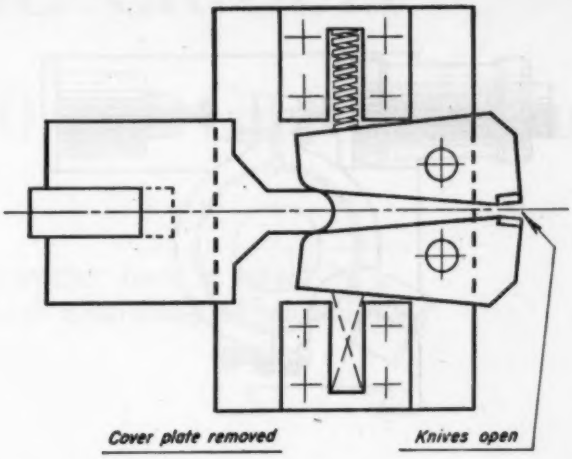


FIG. 3. DETAIL OF the bulldog wire gripper. Four steel balls running in a cone grip the wire as it is pulled forward from the guide pulley into the rotor. The gripper balls release the wire on the return stroke.

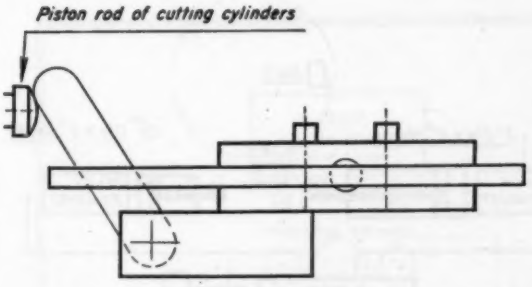
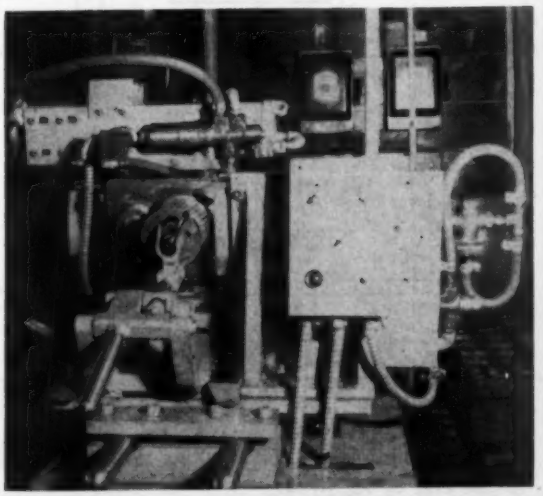
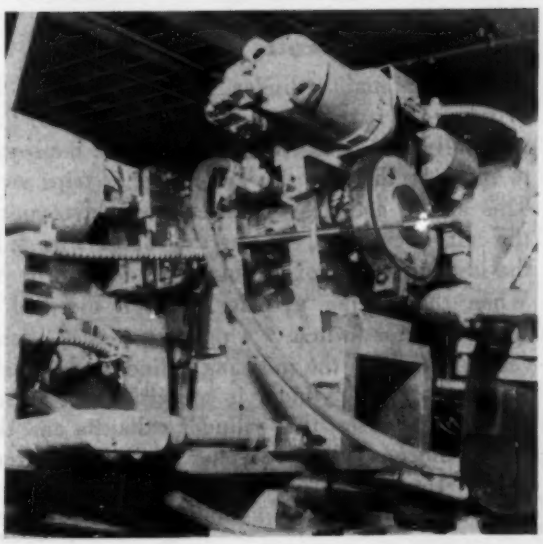


FIG. 4. CUTTERS are actuated by a single acting air cylinder. The piston rod actuates a lever which closes the knives through a wedge action. With the wire cut off the rotor then indexes one hole.



FRONT VIEW of the machine shows the rotor loaded into place. A steel rod is used to line the rotor up with the wire feed tube. The rod is removed after the rotor has been clamped and the automatic cycle is started by a push button.

SIDE VIEW shows the two cylinders which control the pawl and ratchet indexing mechanism. The bulldog gripper is seen at the right, with copper wire being fed through it into the tube. On the left is the cutoff cylinder.



rods trip the switch which cause the main cylinder to operate on its forward stroke.

In order to ensure the line-up of the rotor and index plate a steel wire rod of the same diameter as the copper wire is passed through both rotor and index plate which is removed as soon as the rotor has been clamped by a quick lock clamp. The machine is then ready for starting. An air hose from one of the quick exhaust valves on the machine is fed to the bulldog gripper to blow out particles of copper which might accumulate in there.

Operation of Indexing Mechanism

Normally the larger cylinder, in Figure 5, is energized and holds the ratchet firmly against the pawl. The rest of the stroke of the cylinder being taken up by the brake slipping on the drum to which the ratchet is attached. When the indexing mechanism is brought into play, the large cylinder exhausts and the smaller one is energized. This trips the ratchet over the pawl, one tooth. The large cylinder is again energized, the steep side of the ratchet is brought firmly against the

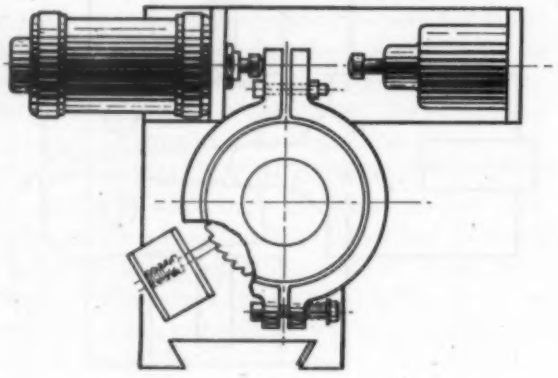
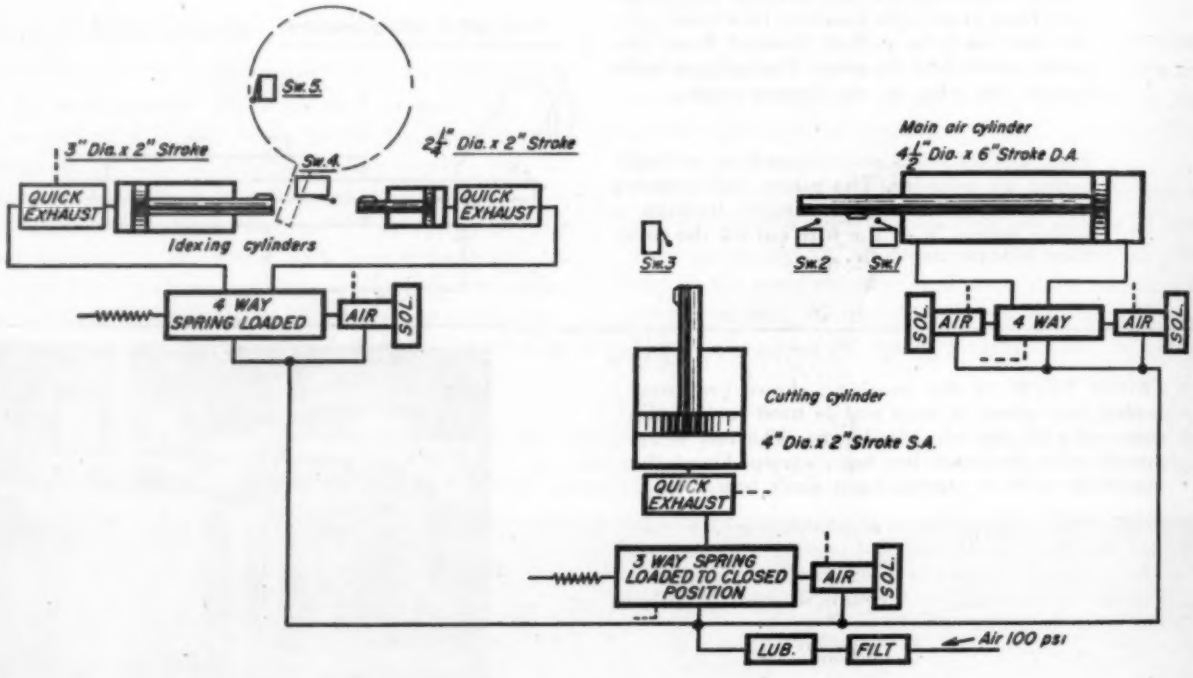


FIG. 5. INDEXING is controlled by these two cylinders. With power to the large cylinder the ratchet is held against the pawl. Slipping of the brake drum takes up the rest of this cylinder's stroke.

FIG. 6. PNEUMATIC CIRCUIT for the copper bar feel and cutoff machine. Speed of exhausting the cutting cylinder largely determines cycle time. Five limit switches control the sequence of operation.



pawl and the brake slips to allow the cylinder to move to the end of its stroke.

Pneumatic Circuit

When the main cylinder, in Figure 6, is at the end of its stroke it trips switch 1 which reverses the four way valve and causes the piston of the main cylinder to move to the opposite end where it trips switch 2. This switch actuates the three way valve controlling the cutting cylinder, causing the copper wire fed in by the last movement of the main cylinder to be cut off. When the cutting cylinder reaches the end of its stroke it trips switch 3 which reverses the four way valve controlling the indexing cylinders. Normally the 3 inch diameter cylinder is energized, but as soon as the valve reverses, this cylinder exhausts and the 2¼ inch diameter cylinder is energized. The latter trips switch 4 which reverses the four way valve of the main cylinder. As soon as the piston rod of the main cylinder has left switch 2, the cutting cylinder retracts and the indexing cylinders return to their normal position.

The process repeats until a projection on the index plate shaft operates switch 5 which open the circuit of switch 1 causing the piston of the main cylinder to remain in the returned position. A push button on the panel of the machine short circuits switch 5 and allows the process to restart.

Speed of operation of the machine is governed to a large degree by the speed at which the cutting cylinder can be exhausted.

The quick exhaust valve first used gave the machine a cycle time of about 60 secs. This valve has been changed and the machine now completes a short rotor in about 48 secs. and the longest ones in about 53 secs.

The machine uses about 25 cu ft free air per minute. About 40 rotors can be completed using 1000 cubic feet of free air. This air costs about 10 cents.

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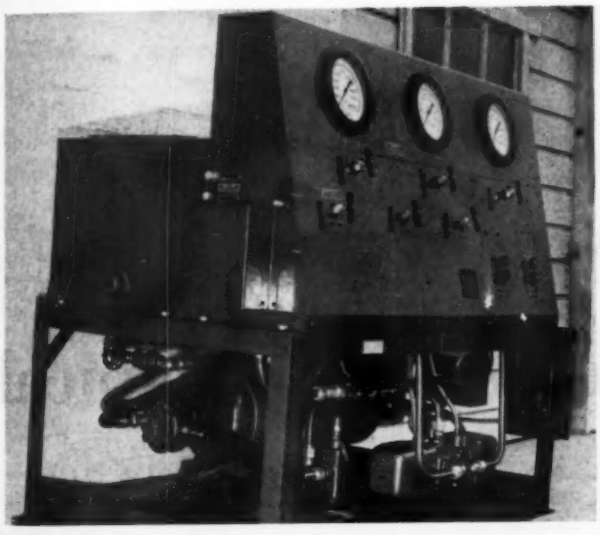
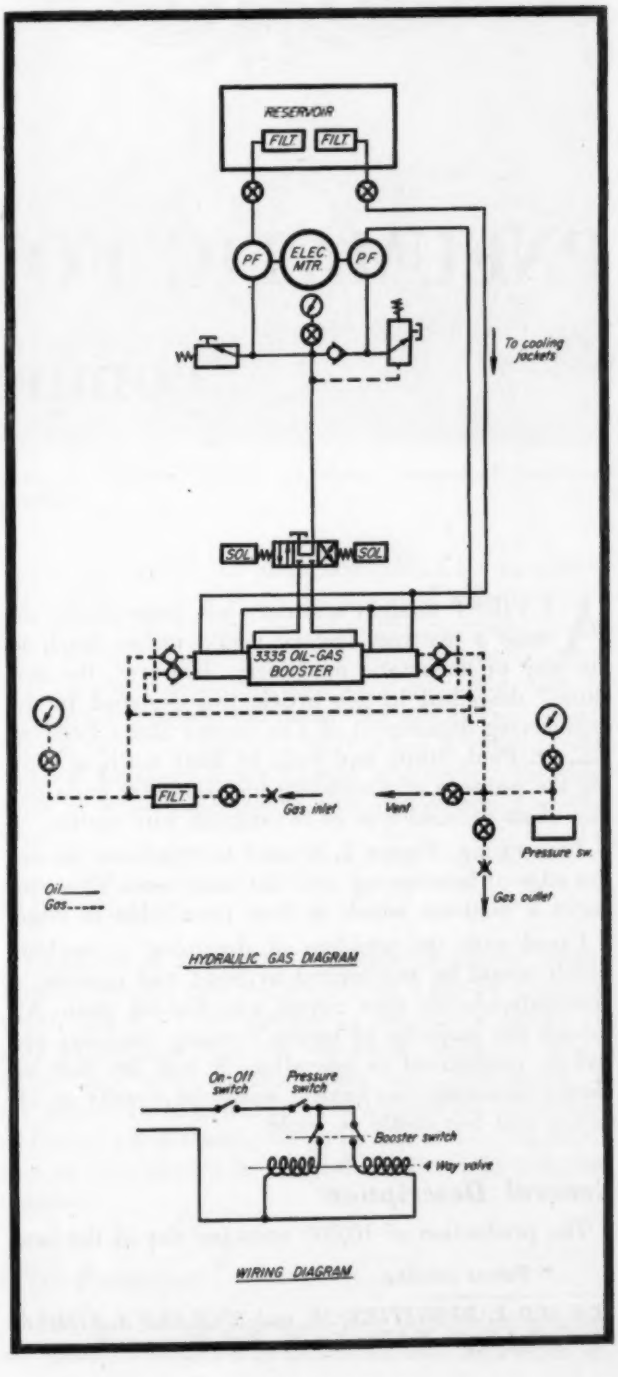
Specially designed gas booster uses a basic two pump circuit to achieve high operating efficiencies



TEMPERATURE control on this gas booster was a problem. To solve it, Haskell Engineering & Supply Co., in Glendale, California, piped the circuit, so that the hydraulic system oil circulates around the gas cylinder. This also increases packing life.

The system is controlled with a solenoid operated, 3 position, 4 way directional valve. Power is supplied by a pair of constant displacement pumps, driven by a double-ended, 10 hp electric motor. Both pumps deliver their combined volumes, to rapidly move the single stage, double acting gas booster. When pressure builds up, the large volume pump is unloaded to the tank. Final hydraulic pressure of 5000 psi, developed by the small volume pump creates gas pressure output of 12,000 psi. At pressures from 1250 to 5000 psi, the gas pump displaces about .9 chm. Check valves, gas cylinders and cycling mechanism reduce dead or unswept volume to less than 1½ percent of total piston displacement, which permits attainment of extreme pressures.

Because gases at high pressures do not follow Boyle's law but behave somewhat in between a gas and a liquid, improved performance in booster output is obtained. Nitrogen for example will vary from Boyle's law as much as 80 percent at 200 atmospheres. The variation is different for different gases and pressures.



1953

APPLIED HYDRAULICS PRIZE PAPER

By Edward L. Bronstien, Jr.
and Richard A. Fisher

PNEUMATIC FORMING competes with mechanical

AT FIRST thought one does not immediately assume a mattress factory would utilize much in the way of pneumatic machinery. However, the machine* described in this article was designed in the engineering department of The United States Bedding Co., St. Paul, Minn. and built by their machine shop for the purpose of producing up to 10,000 units per day of an unusual type of hexangular wire spring.

This spring, Figure 1, is used to reinforce the entire edge of innerspring units for mattresses. This produces a mattress which is firm from edge to edge.

Faced with the problem of designing a machine which would be economical to build and operate, a pneumatic-electric type circuit was decided upon. Although the majority of spring forming machines are strictly mechanical in operation, it was felt that an electro-pneumatic mechanism would be equally as efficient and less costly to build.

General Description

The production of 10,000 units per day of the hexangular spring resolved itself into three distinct operations:

a.) Straightening and cutting 13 gauge hard spring wire preparatory to forming;
b.) Forming the spring and ejecting it to an operator;
c.) Joining the two loose ends to make a continuous one piece spring.

The wire forming machine is completely electrically and pneumatically operated—compressed air at 100-125 psi pressure, and two electrical circuits, one at 110v and one at 220v alternating current.

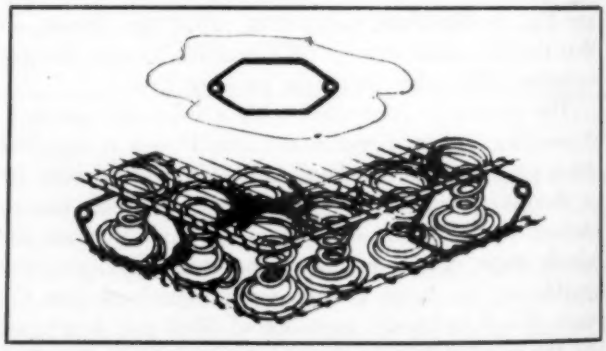


FIG. 1. HEXANGULAR SHAPED springs used to reinforce the edge of a mattress innerspring are formed on an electropneumatic machine.

* *Patent pending*

EDWARD L. BRONSTIEN, JR. and RICHARD A. FISHER, The United States Bedding Co., St. Paul, Minnesota.

Measured by first cost, operating efficiency, maintenance and quality of work, this initial installation of an electropneumatic wire forming machine, in a mattress factory, surpasses pure mechanical types.

The nucleus of the automatic cycle of operation is an electric timer. This timer consists of a small synchronous motor which drives a cam shaft; in turn, each of the ten adjustable cams on the shaft has its own limit switch so positioned that the cam lobes actuate these switches. The limit switches are wired to the solenoids on various air valves and when these valves are energized, they direct air into the cylinder which is designated to work at that time in the cycle. Figure 3 is a schematic diagram of the air circuit employed in this machine. Figure 4 is a schematic wiring diagram of the electrical circuit.

Using this approach, it was then easy to attach the feeding mechanism directly to the forming machine—tying it into the circuit through the timer.

The cycles of operation are the following:

1. Feeding through the rollers to position the wire and cut off the necessary length.
2. Bottom die striking and holding the wire in position.
3. Wrapping gears twisting loops by means of a rack and spur gears.
4. Top die striking to finish the spring.
5. Ejecting the spring and automatically repeating the cycle to begin another spring.

The total time cycle may be varied by changing gears in the timer motor. The timing for each individual operation in the cycle may be varied by increasing or decreasing the relative angle of the cam lobe in relation to the preceding or following cam lobe on the shaft. The restrictions to this adjustment are:

1. Enough of an angle must be maintained to permit each operation to do its work.
2. The cumulative total of all the angles from the first to the last must not exceed 360 degrees.

This particular machine completes one full cycle every 5 seconds.

The machine is very compact and contains only the timer, double solenoid air valves, cylinders, and a small mechanical assembly for the forming and ejecting operation. Most of the parts are standard and are re-usable in similar operations if the machine is ever dismantled for any reason. This feature is one excellent reason for choosing this particular type of machine construction over a purely mechanical device.

Wire Feed

To start the automatic cycle of operation, the master switch is closed and the timer motor begins to revolve the small cam shaft. The first of the 10 cams on the shaft actuates its limit-switch. This limit-switch is wired to one side of a double solenoid operated air valve and directs air into the feed cylinder, driving its piston rod and gear rack to the end of its stroke. By means of roller clutches, the feed cylinders are rotated and the wire is pulled from the coil and fed into a wire cut off die block and behind a wire guide-plate. With the first slight movement of a floating piston in the feed cylinder, the adjustable normally closed limit-switch in the feed roller housing is opened, causing the timer motor to stop after actuating cam 1. After completing the full downward and upward stroke for the total wire feed, the limit-switch is again closed causing the timer motor to start and revolve the cam shaft to actuate the second cam and switch 2 of the timer.

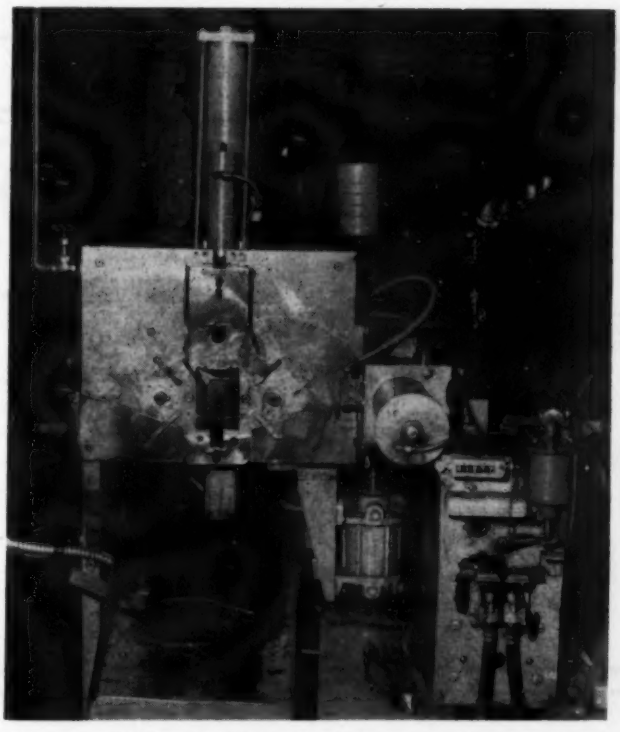


FIG. 2. FRONT VIEW of timer controlled forming machine.

Wire Cut-off

Limit-switch 2 actuates one side of an air valve. This directs air into the bottom of a cut-off cylinder which forces a knife upward to cut off the length of wire protruding from the die block. With the timer motor still running, third cam and limit-switch 3 are actuated which will in turn actuate the other side of the air valve causing air to be directed to the other side of the cylinder to lower the knife to its original position.

Wire-Forming

Cam and limit-switch 4 are then engaged to actuate one side of a valve which directs air into the bottom of

Pneumatic Forming Machine

a cylinder whose piston rod is mechanically attached to a movable die. This die is forced upward against a stationary die and crimps the wire in the shape of three sides of a hexangular polygon. While the die holds the wire in this position, the opposite ends of the wire are forced against two coil forming housings. Cam 5 of the timer starts another cylinder which has a gear rack attached to its piston rod. This rack engages two symmetrically positioned spur gears causing them to revolve. These gears in turn revolve two forming dogs which engage the ends of the wire and simultaneously revolve and wrap the wire around the

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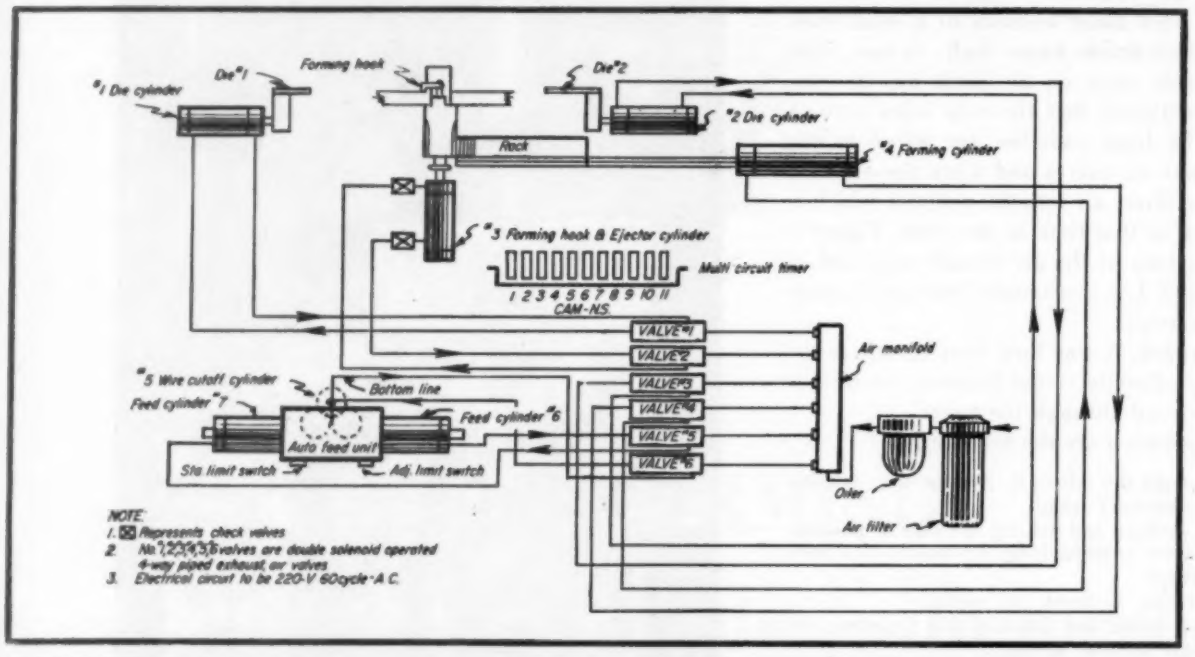
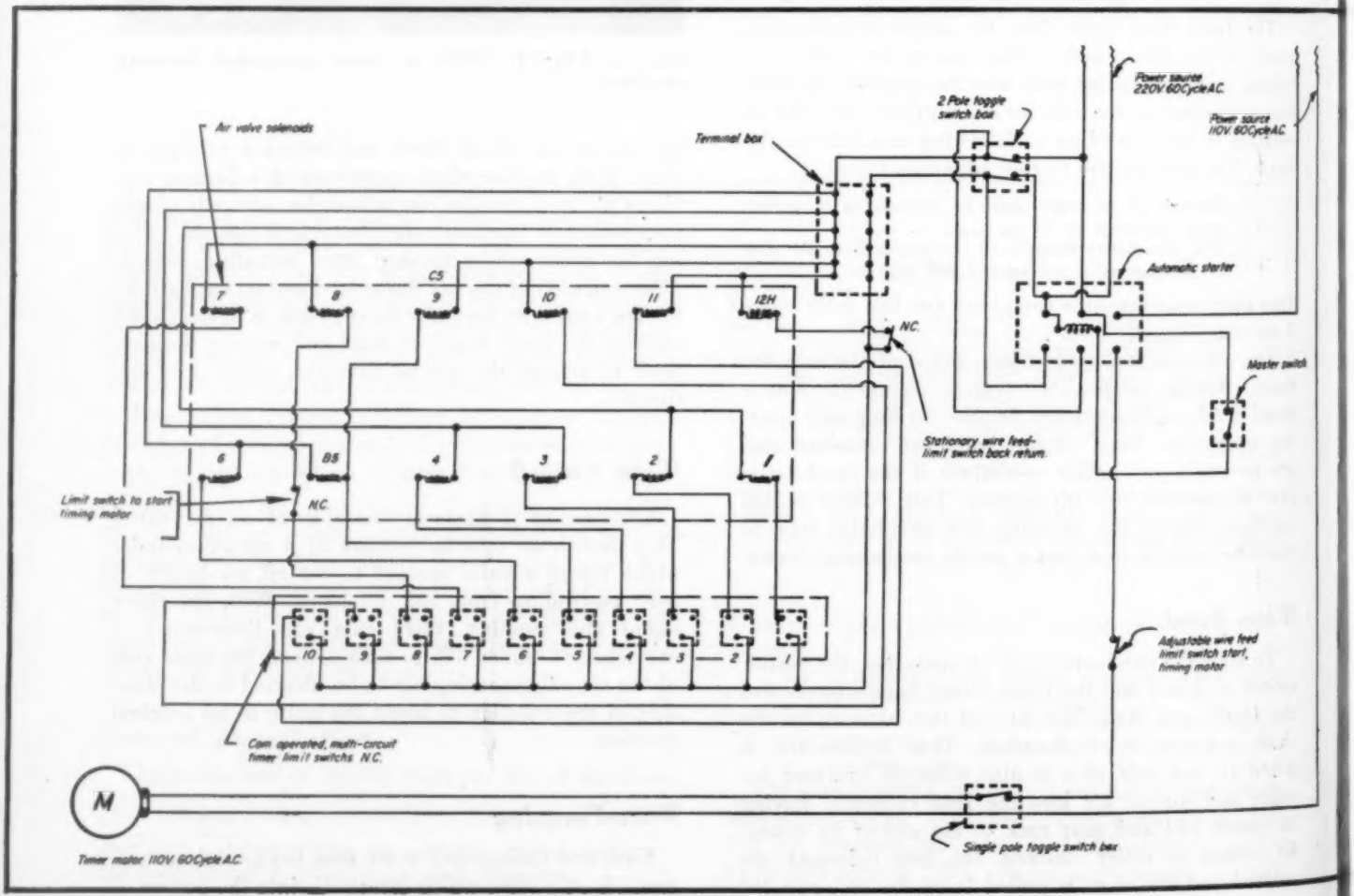
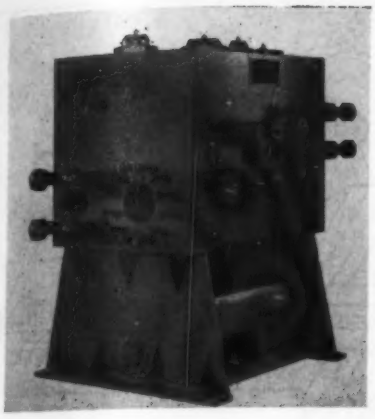


FIG. 3. AIR CIRCUIT for wire forming machine.

FIG. 4. ELECTRICAL CIRCUIT includes a synchronous motor timer which drives a camshaft having 10 cams. Each adjustable cam actuates limit switch.





Photos show main control valve block and a prefill valve.

DESIGN of HYDRAULIC SYSTEMS for Heavy Presses

Part 2 Valves

By Arthur Greensite

WHILE the functions of heavy press valves parallel those of their counterparts in oil hydraulics, there are in many cases radical differences in design and construction. Essentially, the main reasons for these differences are:

1—Water, instead of oil, is the fluid medium
2—Higher flow capacities at higher pressures are required.

A complete discussion of the considerations leading to the design of a high pressure, high capacity, directional control valve (or simply "Control Valve") would be quite lengthy and is beyond the scope of this article. However, the main features of such a valve may be discussed and its operation analyzed. Such a valve is illustrated in Figure 1.

It consists of a forged steel valve block, "A" in which are mounted four valve bodies "B". The valve block is drilled and bored to receive four flange pipe connections and convey the working fluid through the valves in a predetermined manner.

Each valve body contains a spindle which is actuated by a cam, solenoid, or other means. In the neutral position, all spindles are down and all valve ports blocked. For sequence operation, the cams which actuate the spindle are mounted on a common shaft.

To describe the operation of the valve, consider first valve body "B". In the position shown, fluid in chamber "C" is sealed off from chamber "D" by means of the cone seat "E". This seat is ground and lapped making it completely leakprook. Pressure in chamber "C" is available in the chamber surrounding spindle diameter "H", and through a hole in "G" is also available about spindle diameter "F". Diameter "H" is slightly greater than diameter "F" and the pressure on this difference in area acts to seat the spindle on the cone seat together with the pressure due to spring "J". The four valve bodies act in effect as stop valves, and when combined in a valve block as shown in Figure 1, act in the same way as the conventional four way valve in oil hydraulics.

The design is adaptable to almost any size or pressure, and with suitable disposition of valve bodies and stem control, can perform a multitude of functions with a maximum of economy in space and cost.

Problems with Spindle Type Valves

As a directional control, a shifting spindle type valve is rarely used in heavy press installations. Why this is so will become apparent in discussing the inherent limitations of the shifting spindle design.

In the first place, there is the phenomenon of "seizing" or "locking", a condition whereby the resistance of the spindle to shifting is so great as to render the valve inoperative. This is due to the eccentric annulus that is inherent in the clearance fit between spindle

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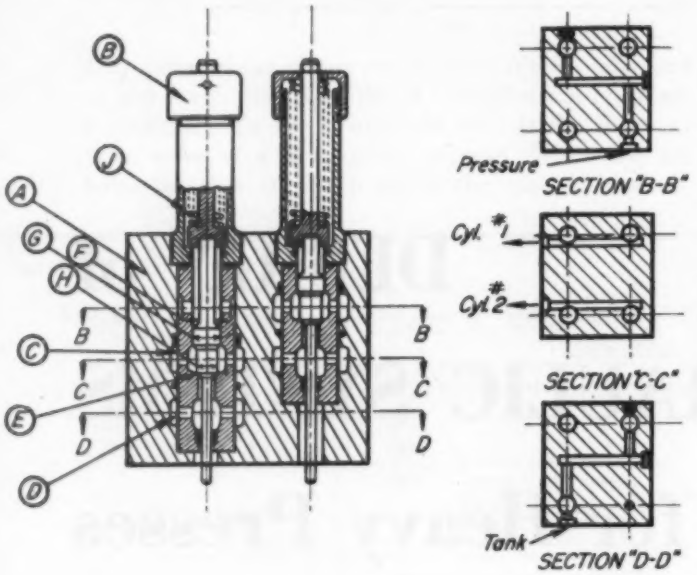


FIG. 1. Control valve design handling large volume high pressure water on a high tonnage press.

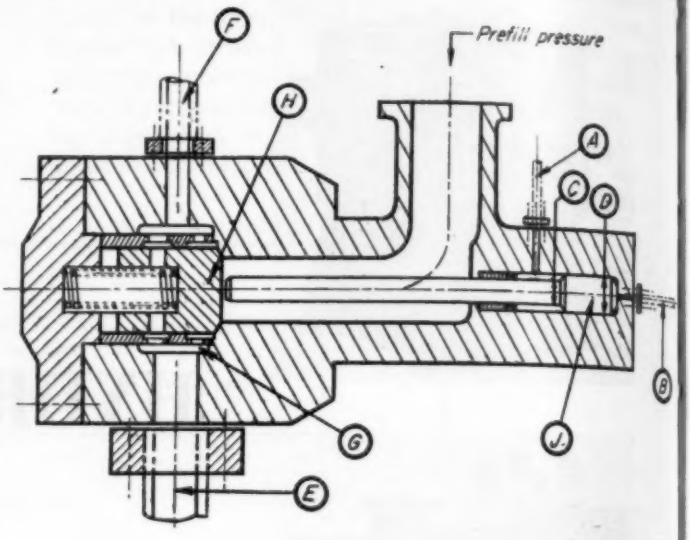


FIG. 2. A 12 inch prefill valve capable of sustaining 6750 psi has been designed for the heavy press program.

and bore; fluid pressure in this annulus tends to "lock" the spindle against the bore and considerable force must be exerted to overcome this "friction effect". For this reason, some power means, either in the form of a solenoid or pilot pressure, is used to shift the spindle in the larger valve sizes and at higher pressures.

The fact that some clearance between the spindle and bore is inevitable, brings up the problem of leakage. Since the viscosity of water is less than one hundreth that of the oil generally used in oil circuits, the shifting spindle design must be completely discarded where leakage cannot be tolerated.

Prefill Valve Design

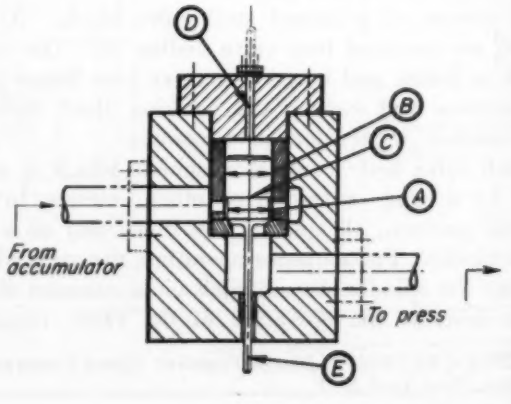
A typical prefill valve in Figure 2 is illustrated. High pressure water enters from pipe connection "F" to annulus "G" and acts to seat plug "H" on its seat. Annulus "G" is open to cylinder connection "E". When operating to admit low pressure or prefill water during the advance stroke, high pressure water is shut off at the main control bank. Prefill pressure is then sufficient to lift plug "H" and permit the flow of prefill water into the cylinder. At the end of the prefill stroke, the high pressure water is then directed into the valve by operating the main control valve and this seats plug "H" automatically. On return stroke, the high pressure connection is shut off and pilot pressure is introduced at port "B" acting to raise stem "J" which is normally held in the down position by constant pilot pressure at port "A" acting on the difference in areas of diameters "C" and "D". Lifting stem "J" raises plug "H" permitting the exhaust water to enter the prefill tank.

The prefill valve is the largest valve on the press. For the Air Force Heavy Press Program, Loewy Engineers have designed a 12 inch prefill valve to sustain 6750 psi. The valve, almost 9 feet high, is the largest high pressure valve ever designed.

Automatic Shut Off Valve

Use of an automatic shut off valve is an important safety feature in a heavy press installation. Such a valve is shown in Figure 3. For normal operation, high pressure water flows from the accumulator to the main controls as shown; the plug "C" being held in the up or open position by the pressure acting on the shoulder represented by the difference in area of

FIG. 3. Pilot operated shut off valve is an important safety feature in the hydraulic press circuit.



Where's the Heavy Press Program Now?

TEN heavy presses are still on the Air Force's program. The cut made last summer chopped off four out of eight forging presses and three out of nine extrusion presses.

Of the remaining program Loewy Construction Co., Inc. is building one 50,000 and one 35,000 ton forging press along with three 8000 and one 12,000 ton extrusion presses. Mesta Machine Co. is working on a 50,000 ton forging press and United Engineering Corp. is scheduled to supply Alcoa with a 35,000 ton forging press. One 12,000 ton extrusion press is being built by Lombard, Inc., and a 13,000 ton extrusion press built by Schloeman in Germany completes the presently scheduled program. One of the cancelled forging presses, a 35,000 tonner being built by E. W. Bliss Co. was too far advanced to be junked. Its main members will be completed and stored.

There are still problems. While the presses have been designed, and building and installation is underway, machine tools to handle the products of these giant presses must be fully worked out. Also experience in the use of heavy presses is limited. Much is still to be learned about tooling design, resultant tolerances and size of the work-pieces.

Too Much Capacity—Too Much Money

There are economic reasons for cutbacks in the press program. The original eight forging presses had an estimated output of forgings totalling more than 10 times the weight of metal used in a peak month for forgings in the whole military airframe program. The jump in press sizes and press capacity was just too much. Budget for the original program was $389 million, because of rising costs the cut-back program alone will cost about $300 million.

diameters "A" and "B". Any abnormal condition, which requires shut off of water, acts to introduce pilot pressure at port "D" forcing plug "C" down. The purpose of stem "E" is to cut down the effective area of the underside of plug "C".

High Pressure Throttle Valve

A high capacity high pressure throttle valve is shown in Figure 4. High pressure water, available in chamber "A", is throttled into chamber "B" through stem "E". The valve is operated by means of a motor "C", and stroke limits are controlled by limit switch "D".

The valves covered in this article are basic types and innumerable modifications exist to perform special functions. To perform the function of flow control, for example, an auxiliary sleeve is introduced in the valve body of Figure 1 so that, as the stem is raised to open the valve, only a predetermined number of small holes in the sleeve are opened thereby controlling the speed of the operating unit; speed variations in the latter may, by a feed back arrangement, act on the stem to produce a substantially constant speed.

The next article in this series will discuss some elementary circuits for heavy presses utilizing these valves. A final article will cover some of the ramifications of the control problem with special emphasis on safety and hydraulic shock.

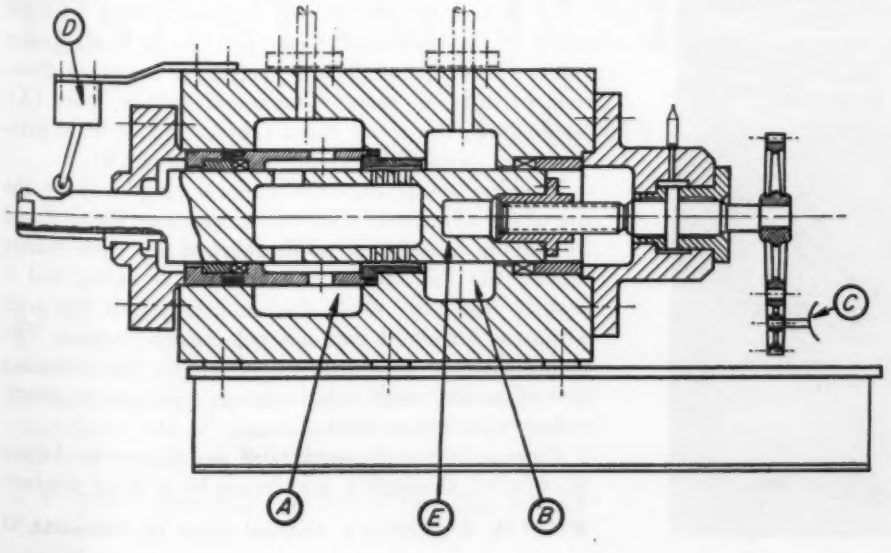


FIG. 4. Stroke limits on this motor operated throttling valve are controlled by a limit switch.

Honorable mention awards were given to the following two articles submitted in the APPLIED HYDRAULICS Prize Paper Contest

Hydraulic Control System

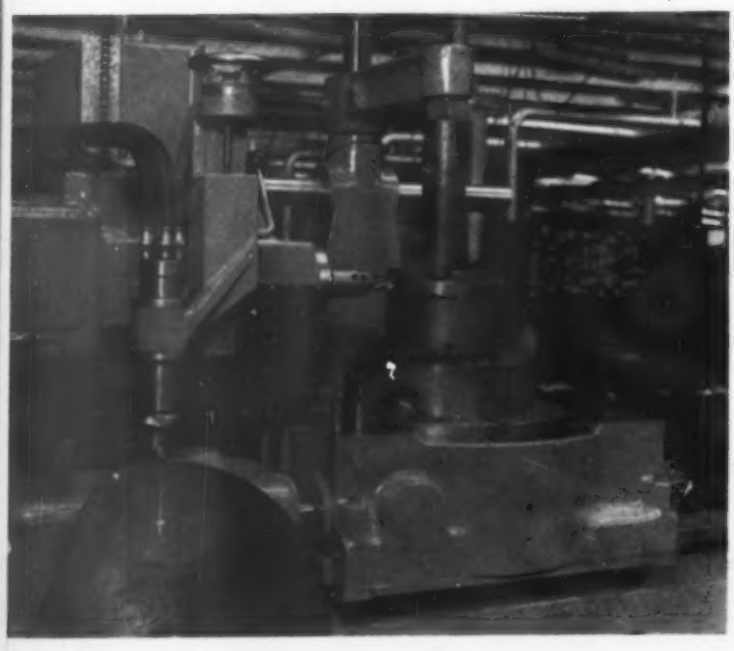
for cam milling machine

By William F. Morgan

ONE of the most costly jobs in a machine shop is the production of cams for automatic screw machines. For the machining of drum cams used in the National Acme Company's machine shops, a special hydraulically controlled milling machine was designed and built.

Because the cam miller is required to turn out cams with various "leads" and "rises", machine setup had to be simple and fast. Hydraulic operation was selected for the contour control mechanism, and, because infinitely variable speed control was desirable for the tool spindle drive, the master former drive and table drive, hydraulic transmissions were selected for these operations. Also movement of the work table for loading the work is accomplished by a hydraulic cylinder.

OIL POWER drives the tool spindle, the work table, and the master former. An oil controlled tracer mechanism gives a cam cutting accuracy of .001 inch.



Layout of the machine and the hydraulic circuit is shown in the accompanying illustrations.

For the spindle drive circuit a constant torque hydraulic transmission is used. This includes a 10 hp electric motor driving a variable displacement axial piston pump. The pump supplies oil to a fluid motor which drives the tool through a gear train. Along with the relief valve, extra overload protection is provided by the pressure switch.

The tool spindle housing is mounted on a combination of "V" and flat ways. Movement of the milling cutter must accurately follow the master former. Contour control is accomplished by a follower circuit. The tool head is actuated by a differential cylinder (B). Movement of the cylinder is controlled by the tracer valve (D), connected to the rod end of cylinder (B), and the volume from the 3.3 gpm pump connected to the head end. This pump pressure is also directed to the pressure port of the tracer valve. Oil at constant pressure of 800 psi, as determined by the relief valve setting, is supplied to the head end while a controlled source is supplied to the rod end by the tracer valve. The unbalancing of volumes created through the tracer spool movement causes the head to move. Movements of .001 of an inch are accomplished.

To protect the work from damage caused by overtravel of the tool head, vent port (X) is in the tracer valve. If the spool should overtravel in either direction because of some mechanical failure, port (X) would open the relief valve vent to atmospheric pressure and drop the pressure on cylinder (B).

Machine setup for each cam is simplified by the use of the adjustable slide (C) to position the tool, and by having a starting point marked on each master former the roll on the tracer valve actuating rod is readily lined up. Once the machine is in line with a master former it can not get out of position. This makes positive duplication very simple. The actuating rod rides in linear ball bushings (E) which greatly reduce side thrust friction.

Power to drive the work table and the master former is supplied through a gear train by a fixed displace-

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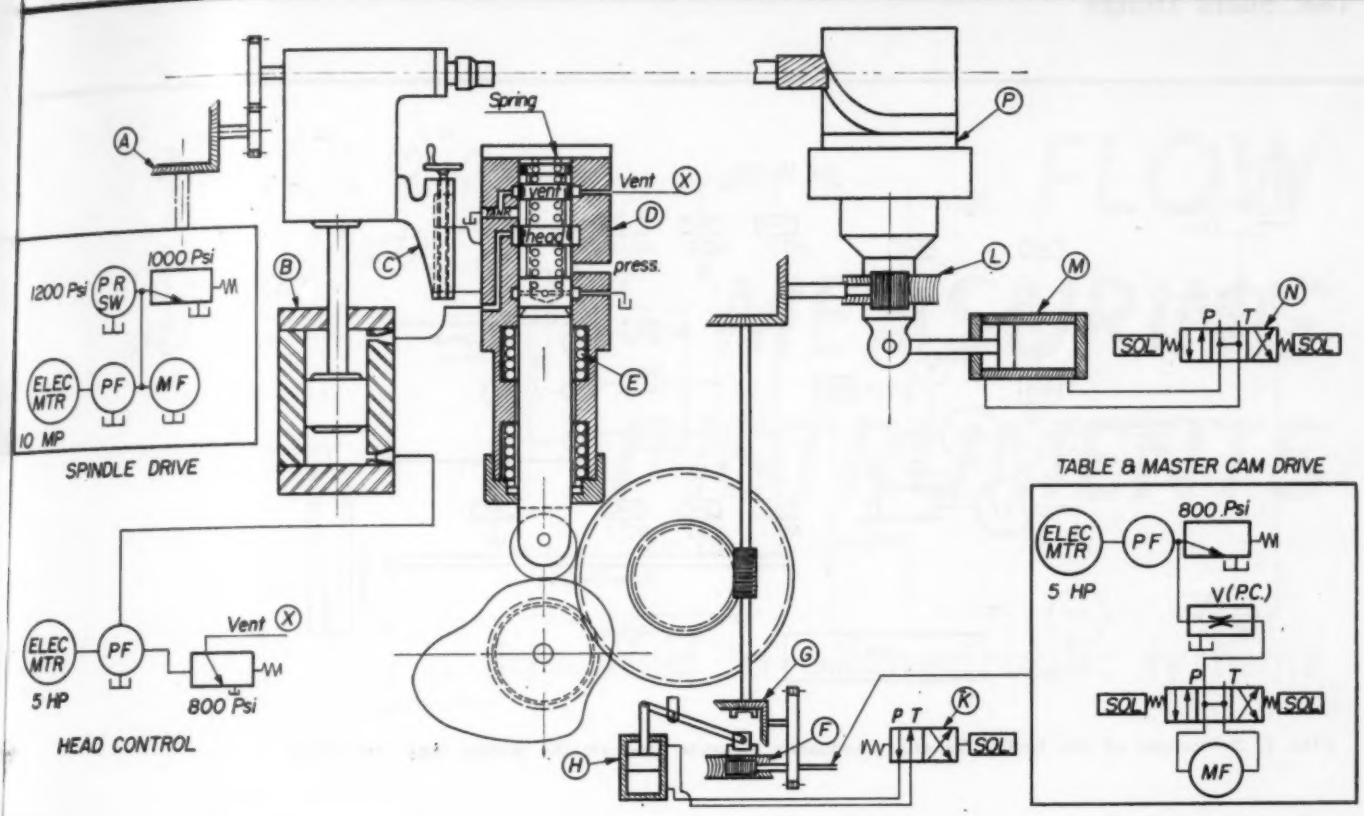

Circuit layout for cam milling machine

ment motor. An 8 gpm pump driven off the double ended electric motor used in the spindle drive circuit supplies oil for the table and master former circuit. Gear trains keep the rotation of the workpiece in synchronism with the master former. Speed of rotation is controlled by the pressure compensated flow control valve which meters the volume of oil to the fluid motor. Direction of rotation is controlled by a four-way spring centered solenoid operated valve. Engagement of the drive for feed or rapid traverse is accomplished with valve (K). With the valve deenergized, worm (F) is engaged to put the drive in feed. Energizing the valve shifts the clutch through cylinder (H) to put the drive in rapid feed. The work table is rotated by worm and worm gear (L) which is driven by the same gear train as the master former. Cylinder (M) moves the work table so that the work can be loaded away from the cutter. Equipping the machine with a sine bar attachment makes it possible to cut the master cam.

TEST STAND DESIGN

to help select piston rings

By R. W. Hoyt

PERFORMANCE requirements for piston rings in the hydraulic and pneumatic field vary more than in any other type of application. The operating pressure, for example, may vary from atmosphere to many thousands of pounds per square inch. Speed of operation may vary from static to once a year—to several thousand strokes a minute. Some cylinders or machines are single acting—others are double acting—and one even rotates.

If we could find out just how a piston ring would react under these different conditions, we could recommend or select the right ring for the job. Therefore, we decided to build a test stand that would be as universal and adjustable as possible. Our budget for

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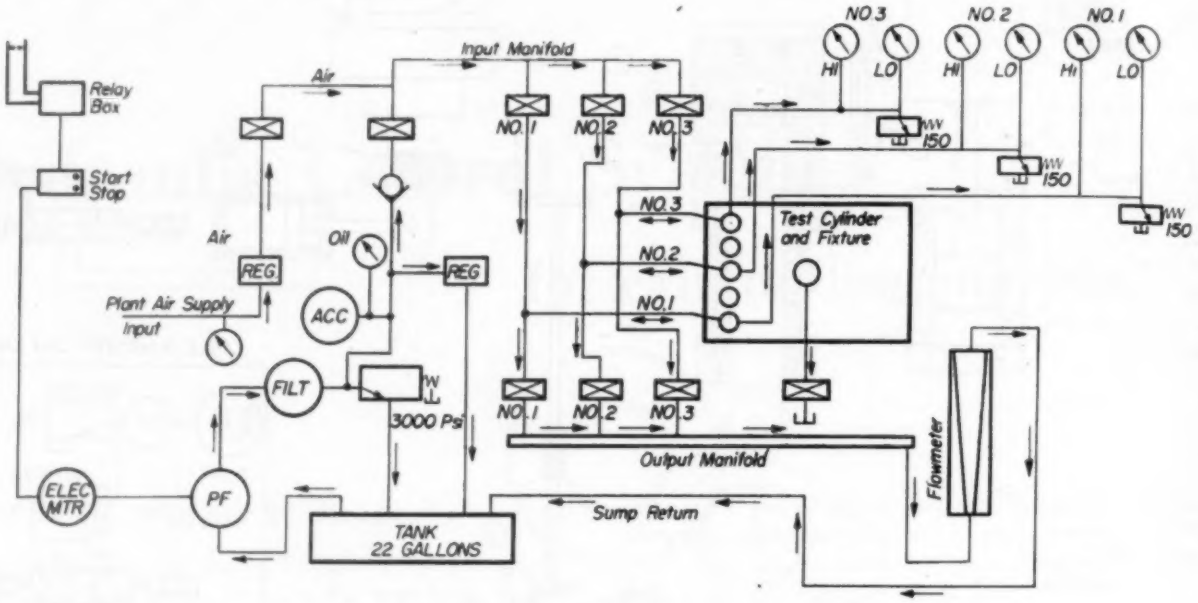


FIG. 1. Schematic of the hydraulic and pneumatic circuits used on the piston ring test stand.

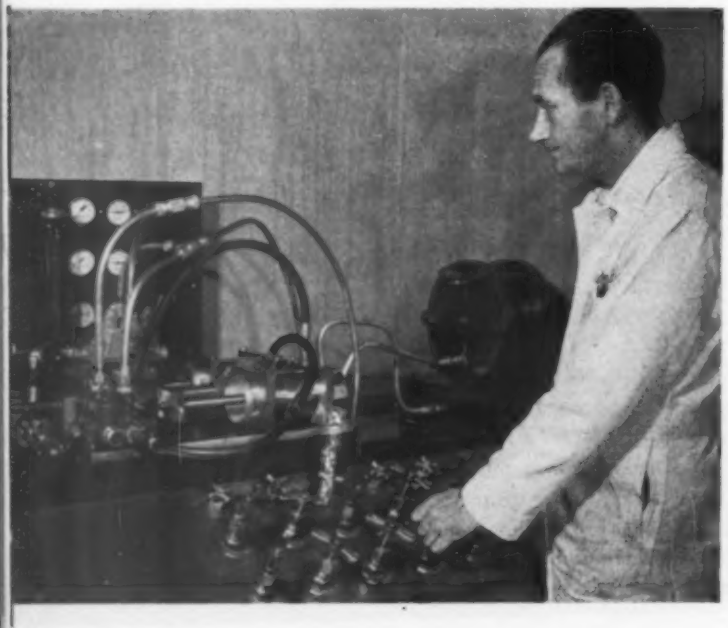
this test stand was very limited.

First, it was necessary to decide what we wanted to test. The three questions asked most often are:

1. What type of ring should be used to do a certain job?
2. How many rings of what dimension are required to do a specific job?
3. How much leakage will result in certain applications?

We found that we could solve a great majority of our problems if we could test piston rings at varying hydraulic pressures up to 2500 psi and varying pneumatic pressures up to 150 psi. By putting these limitations on our test stand, we are able to keep our equipment quite simple and of low cost.

FIG. 2. Test stand being used to test endurance of new types of piston ring coatings.



Cylinder Design

We designed a cylinder of 7.156 inch bore because that was one of the popular sizes for hydraulic cylinders. We placed a piston in this cylinder which had normal diametrical clearance and three ring grooves .312 inch wide by approximately 9/32 inch deep in order to accommodate rings of standard radial thickness. We made piping arrangements which would enable us to take off pressures below each of the individual three rings. This would promptly indicate the pressure differential between each ring and show just how much pressure each ring would hold. We made provision for either applying a static test or a reciprocating test.

Further than this, we connected a flowmeter into the system so we could exactly measure the blow-by past each ring individually. We kept before us the necessity of easy and quick change of pressures and also change of medium from air to hydraulic.

The electric motor drives a fixed displacement pump which can build pressure up to 2750 psi. The oil which then passes through a filter, relief valve, accumulator and pressure regulator is carried to a manually operated oil shut-off valve. Up to this point, there is an entirely separate system for air operation. Air is taken

Concluded on page 132

FLOW MEASURING INSTRUMENTS

. . . applied to oil hydraulic systems

By H. L. Kressin

Measurement of fluid flow is given a great deal of attention because the flow meter indicates both the demand and output of a pump. As engineers we insist on a given output for given load conditions and also evaluate our accomplishments in terms of efficiency. Therefore, our basic problem is to determine the best method of obtaining the flow rate of a pump, so we can determine its efficiency.

IN the field of flow measurement perhaps every form of device has been applied to transform a high rate of motion to a reading that can be grasped with the normally slow response of the human being. We cannot follow a molecule, or even a thousand molecules, at a rate of more than about 20 feet per second if we are allowed to watch it over a distance of one foot. However, experts of the past told us that a moving particle has inertia or energy, and that this energy can be taken from a small mass and applied to a greater mass without a loss in energy, but with a definite motion being imparted to the greater mass. Consequently, a great number of "float" type devices have been devised for flow measurement.

In a later period scientists provided us with other workable theories on what pressure changes can be expected when a liquid passes through a restricted area of a pipe system. We now call this pressure change the differential pressure, and on the basis of this differential in pressure several types of flow meters have been developed.

Other principles have been put to work for flow measurements in the past two decades which at present need more development in order to provide highly effective devices for measuring very small or very large flows at both high and low pressures. These later methods will complete our present working spectrum. One such device gives a flow reading which is dependent on the heat carried away by the fluid. Another device measures flow by sensing the change in a magnetic field as the fluid passes between the poles of an armature-pipe arrangement.

Experience has proven that for an open-circuit test setup the most accurate method of measuring pump output is still the weight per unit of time method. Its error is less than 1 percent for 95 percent of the time, but it must be remembered that time element may be less than .01 percent of the total test time. Flow meters, however, can be maintained to operate within an average accuracy greater than 99 percent.

The Rotometer Flow Gage

Several versions of the inertia-type gages are available. The basic working parts of this type of gage are simply a variable-area meter consisting of a transparent tube, and a metering float that is displaced upward by an upward flow of fluid through the tube.

H. L. KRESSIN, The Franklin Institute of the State of Pennsylvania, Philadelphia, Pennsylvania

. . . flow meters provide continuous pump performance data . . . show effects of temperature change and valve action

The tube and float arrangement is calibrated as a unit. The calibration graduations are placed on the tube or on the body of the meter, and allow the user to read the flow directly. The float, which is normally made of steel, is designed in such a way that it will rotate and rise as the fluid passes. The rotating action helps to establish and maintain its central position in the tube. The freely-moving float not only rotates at a higher speed, but also takes a higher position in the tube with a higher rate of flow. The tube is normally tapered, with the greater area at the top, to prevent the float from restricting the flow and to produce a greater linearity in flow readings over its specified range of operation. These meters are designed around a strong, pressed steel structure that enables them to take full line pressures and hard use.

The Indicating and Recording Type Flow Meter

An additional modernization has taken place in the float-type rotometer. Into the float system of measurement, an electronic system of recording flow readings has been inserted by coupling the rotometer float to

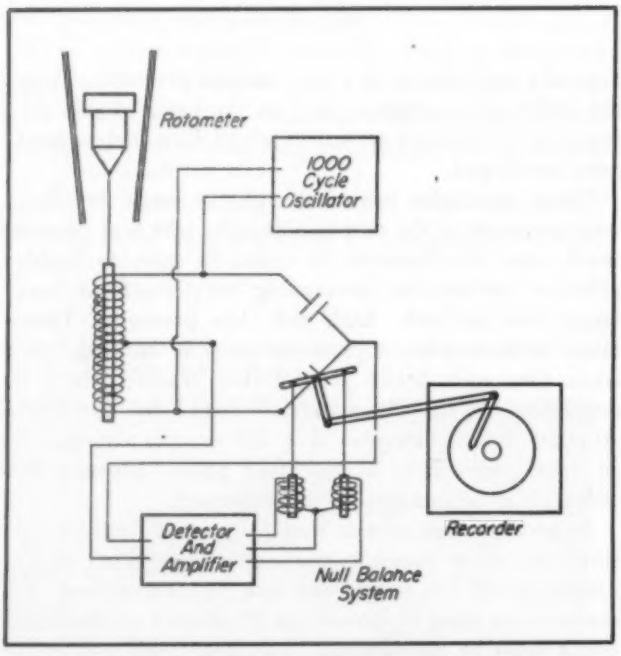


FIG. 1. Indicating and recording type flow meter uses the basic float system of measurement and an electronic system for recording readings.

a probe system which changes the inductance in a coil system, Figure 1. The probe or stem of the float is made of soft iron and is allowed to move with the float. A coil of a great number of turns is supported around this stem in an extended body of the meter. This coil is center-tapped so it can be used as two legs of a Wheatstone bridge circuit.

For a condition of no flow, the bridge circuit is balanced, and its output to the recording device is zero. For a flow condition, an unbalance occurs between the two ends of the flowmeter coil; that is, the upper coil has a greater amount of inductance than the lower coil. This unbalance is then amplified and fed into an unbalance-detector circuit. This circuit drives a null balance system for instantaneous recording.

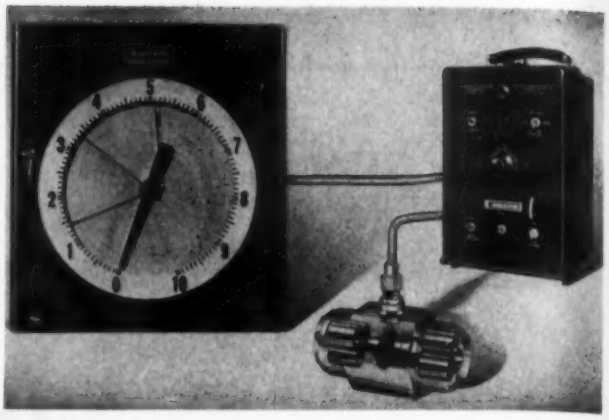


FIG. 2. Turbine type flow meter has a rotor which spins at a rate proportional to the velocity of the fluid passing through.

Null balance systems are normally drift-free and quite stable; the detecting device is not required to supply power to any part of the system and acts only as a relay in the total system. Electrical devices which use the null method have an additional advantage in that the electromotive forces are balanced and no current flows through the galvanometer circuit at the moment of measurement. Nor is this circuit influenced by variations in the electrical resistance of conductors, inequalities in windings or by variations in the strength of a magnetic field.

It is felt that the inertia-type gage has a very definite place in performance and endurance testing of pumps. It will provide continuous pump performance data which can be checked against other performance data such as effects of temperatures, or the effects of valve action on the pump system. For this type of meter a calibration of the recording system can be checked against the rotometer position at any time by comparing the chart record with the graduations on the tapered tube. These recording devices can also be provided with a mechanical-electrical device which will count the total number of gallons pumped during the period of testing.

Turbine Type Meter

Another variation in rotometer design has also appeared, lending itself to measuring and recording fluid flow, it uses only the rotational motion of the float. This meter, Figure 2, can no longer be classified as a float type. The sensing element consists of a housing designed for direct mounting in a flow line. The housing supports a rotor which spins at a rate proportional to the velocity of the fluid passing through the unit. This rotor contains an internally-mounted permanent

This is the third article in a series describing instrumentation technique applied to the development of hydraulic circuits. "Electronic Instrumentation", the first article, appeared in the April issue and described devices for measuring pressure, strain, force and motion. "Temperature Measurement" was the subject of Mr. Kressin's second article in July. Vibration measurement and control devices will be the subjects of subsequent articles.

magnet that generates a voltage in a pick-up coil mounted on the outside of the sensing-element housing. The frequency of this induced voltage is the same as the rotational speed of the rotor, which is proportional to the rate of flow.

In this type of meter the speed of the sensing rotor is almost entirely independent of fluid viscosity, pressure, temperature, specific gravity, and other varying factors in fluid characteristics. The signal generated in the pickup coil is normally fed into the highly stable converter that transforms it into a continuous voltage whose magnitude is proportional to the frequency of the signal. From this conversion point, a standard strip chart or circular chart recording instrument can be used.

Orifice Type Meters

Another widely used flow meter is the differential or head meter, Figure 3. This device embodies a constricting orifice, which when placed in a flow line will create an artificial pressure drop in the line that is directly related to rate of fluid flow in the pipe. In its simplest form the sensing device is a U-tube manometer, and the flow rate Q is proportional to a constant for the orifice times the square root of the pressure difference.

For many applications the conventional mercury manometer can serve satisfactorily as the sensing device, but why stop there? The process of converting those readings to flow readings is definitely time-consuming, and tedious. There is also the possibility of transferring the mercury in the manometer into the system. Since the pressure change is virtually instantaneous across the orifice and since a mercury manometer will not follow quick changes in pressure, it seems to be against good judgment to use only a mercury manometer. Instrument manufacturers have replaced the mercury manometer with a "mercuryless"

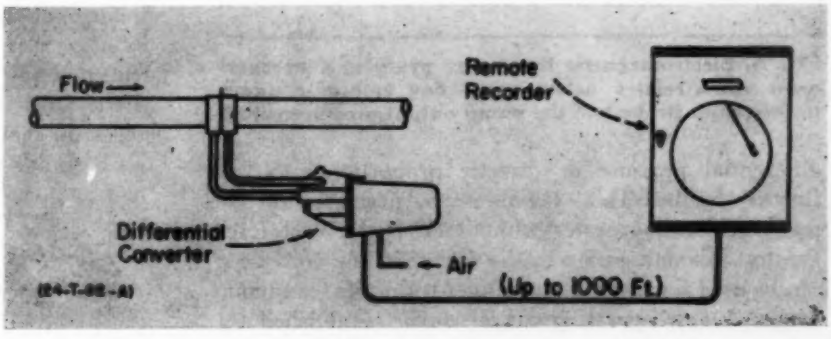


FIG. 3. Orifice type meter creates a pressure drop in the fluid line that is directly related to the rate of fluid flow.

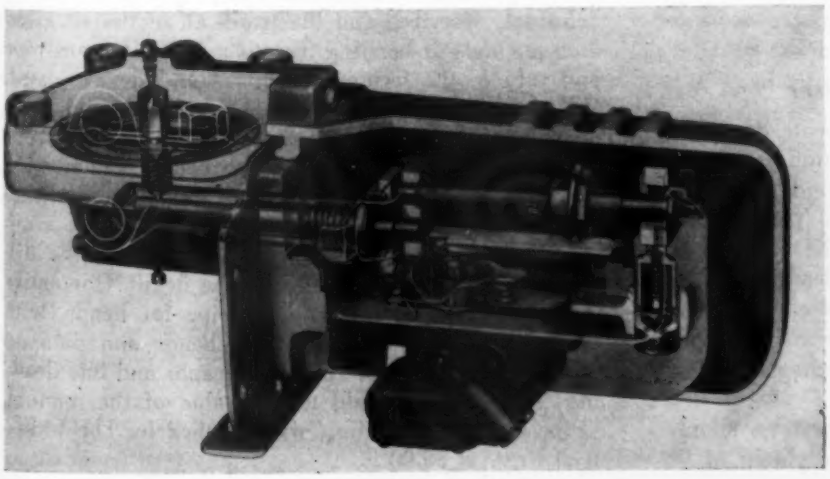


FIG. 4. Differential converter used in the orifice type flow meter. Air pressure opposes the motion caused by the differential pressure. Flow of air from the converter can be made directly proportional to the flow in the line.

type of manometer that will sense the differential pressure and will transmit the measurement to a flow recorder. The sensing device, Figure 4, is a diaphragm whose sides are subjected to the two pressures. The mechanical motion of the diaphragm is transmitted through a mechanical balance beam to a pneumatic-balancing bellows and a flapper nozzle system. Air pressure from the supply is then bled through a restriction into the pneumatic-balance system and acts in opposition to the motion or force caused by the differential pressure. Therefore, the flow of air from the converter can be made directly proportional to the

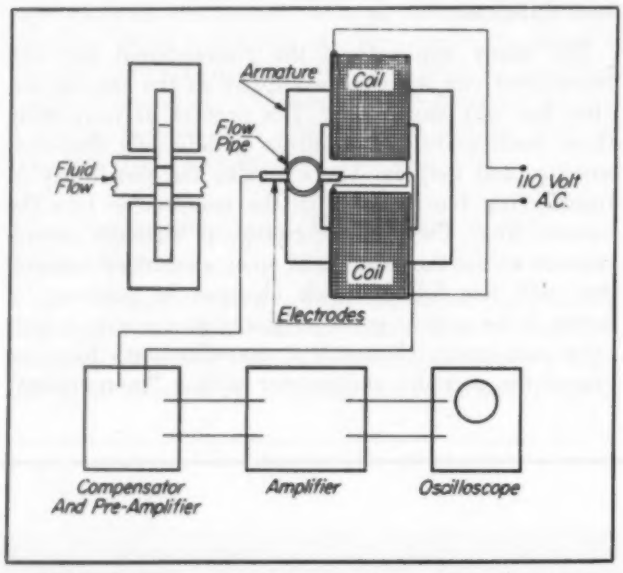


FIG. 5. Electromagnetic flow meter provides a measurement which relates instantaneous flow rate of a pump to the pump stroke and the pump output pressure curve.

differential pressure or directly proportional to the flow in the line. This system, as you perhaps have already realized, operates without electronic tubes. Its greatest advantage lies in the fact that one converter can be used for several flow ranges within its maximum range. A new operating range can be established by simply rotating a range adjustment nut that changes the fulcrum point of the beam. However, for this system a separate source of high pressure air must be supplied.

The Electro-Magnetic Flow-Meter

It should be noted that the instruments described above are very useful in the determination of general flow data when such tests as long-period endurance tests, production line tests, or general performance tests are required. However, during the early stage of development of a pump, it may be desirable if not necessary to obtain a relationship between the pump stroke, its output pressure curve, and the instantaneous flow. To accomplish this a new electromagnetic flow meter, Figure 5, is available.

Basically the electromagnetic flow meter is simply an electromagnet whose pole pieces are placed at 90 degrees to the direction of a flow line. If a fluid is allowed to pass through the tube, the magnetic field will induce an emf in this fluid proportional to the rate of flow. The fluid acts like a conductor in a normal magnet-conductor circuit. The intensity of this emf can be measured across two electrodes with a sensitive galvanometer. The electrodes are placed in the same plane as the magnet but at 90 degrees to the pole pieces. This output could also be amplified and then measured or viewed on a cathode-ray oscilloscope. This system will work satisfactorily if either a constant or altering magnetic field is established by the magnet. This system performs equally well for both turbulent or laminar flow. However, under both conditions, it measures the average velocity of flow.

The hydraulic engineer, and the process-control engineer who use flow measuring instruments have separate and distinct problems. One, the hydraulic engineer, is concerned with the development of a single component, whereas the process control engineer controls a number of components in a continuous manufacturing process. However, in both cases the engineer must have a complete picture of how his system is functioning. Also, both must first measure the parameters of their systems. Controlling these parameters is only an additional phase that has lent itself to proper component operation.

It should also be remembered that all flow measuring devices possess very definite characteristics that determine the success with which they can be applied not only to a development program, but also control of a given process. This is especially true in the measurement of fluid flow in pipe lines, and its control is definitely one of the most important concepts in the determination of pump capacity. It also ranks as one of the most important in the field of industrial processes, in that it permits the determination of quantities of fluids pumped.

New Book

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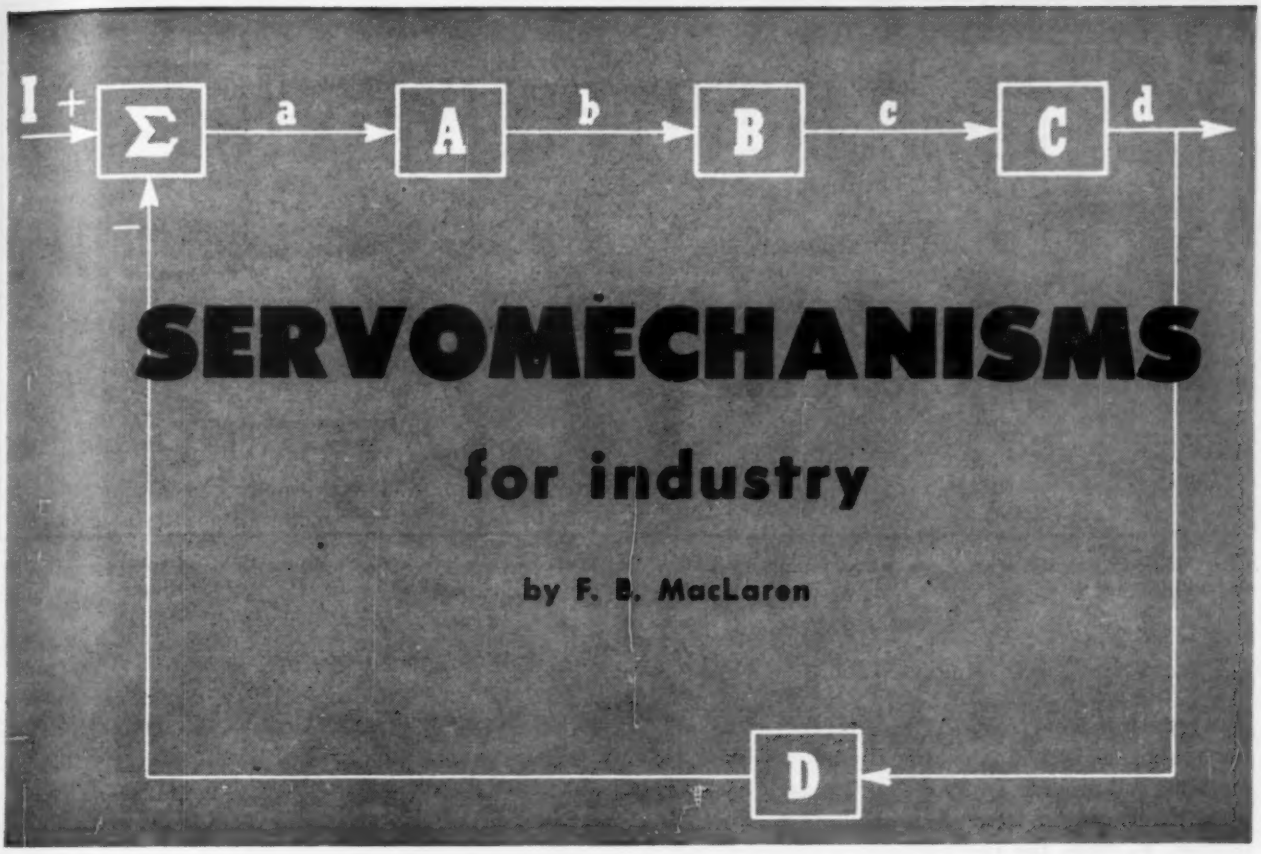
This practical working manual, prepared by Paul S. Schubert, describes and illustrates all of the six common methods of bending ferrous and non-ferrous pipe and tubing, the fixtures machines and devices used. Written for shop and field men, designers and engineers, the descriptive information and data on various methods is arranged so that the reader may become familiar with their respective advantages and disadvantages. Each method is taken up in detail, the available machines described and procedures for the different types of bending are given in detail. One entire chapter is devoted to layout of pipe for bends, with formulas for various degrees of bends and data on minimum bends. Over 150 photographs and line drawings and 15 tables add to the value of the manual. "Pipe and Tube Bending" is published by The Industrial Press at $5.00.



SERVOMECHANISMS for industry

by F. B. MacLaren

Part 3

Industrial Applications

(Concluding section of a three part article)

ALTHOUGH servomechanisms have been used in certain industrial processes for many years, their full capabilities have only been realized in specialized fields during the past decade. A great many new applications are now possible, utilizing the improved techniques and components which have become available to meet the more stringent military and industrial requirements. Several typical examples of such potential applications will be described, together with some in actual use, which exhibit the trend toward greater accuracy and fidelity of following, or in certain cases, unusual damping means for long time constant processes.

The machine tool industry is one where the application of servo controls is particularly advantageous, mostly for automatic or semi-automatic production of precision parts. Quantity manufacture of turned pieces is now very well handled by automatic screw machines, providing the tolerance requirements are not too severe. Accuracies are obviously limited by the absence of any automatic compensation for wear of the cutting tools and looseness of moving parts, which can only be partly corrected by periodic manual adjustment after spot checking samples of work completed. To obtain better uniformity between individual pieces, a continuous measurement of critical dimensions is necessary, together with automatic means for controlling the feed from the measurement obtained. In other words, a closed loop system must be substituted to overcome the inherent uncertainties of the open loop on a standard machine.

Actually, some form of grinding process is generally employed when high precision is required, and is a relatively costly method due to the time required for checking dimensions during the grinding operation. Wheel wear, lead screw inaccuracies and bending of the work, all contribute to errors between dimensions obtained and the feed calibration. The operator must therefore check each piece at least once before the final cut, which introduces human errors and resulting rejections as well as delays. Figure 1 shows the basic control system for an automatic grinding operation that has proved quite successful in eliminating rejects

F. B. MacLaren, Engineering Consultant, Servomechanisms Inc., Westbury, N. Y.

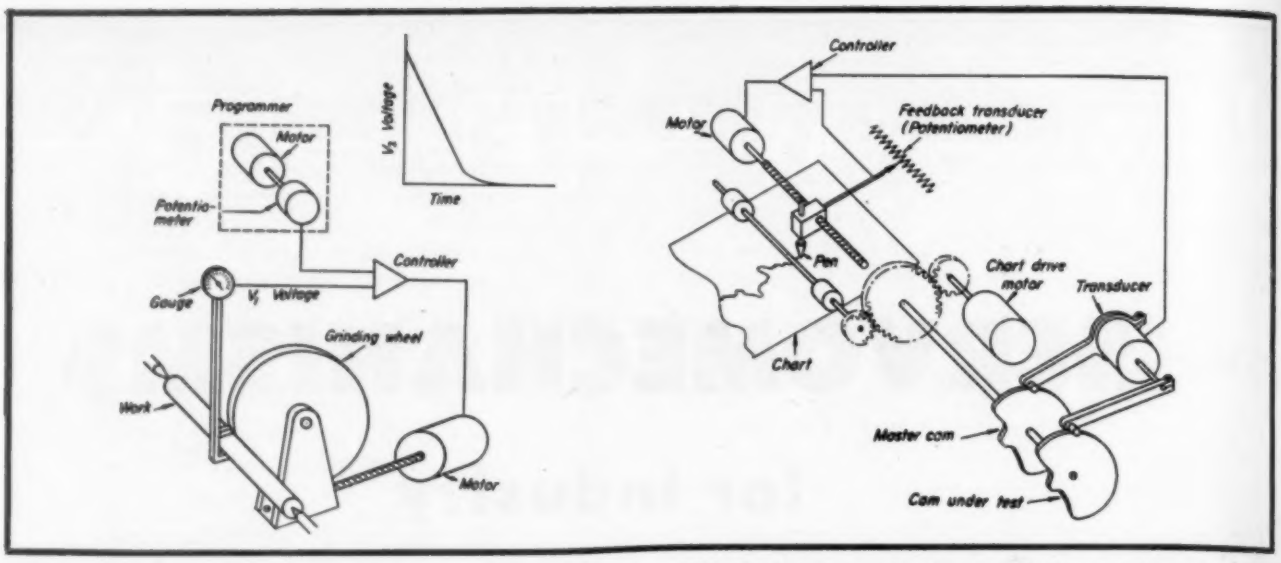


FIG. 1. Basic control system for an automatic grinding operation. Size is accurately controlled by the servo.

FIG. 2. A servomechanism applied as an inspection device checks the accuracy of a cam contour.

and reducing labor costs. A commercially available electronic gage is used to continually indicate the work diameter and provide a voltage V_1 directly proportional to the variation from the size desired. A second voltage, V_2 from the programmer is compared with the gauge output from an error signal which is amplified to actuate a driving motor coupled to the feed handwheel. A typical program curve is shown, whose slope determines the rate that material is removed from the work, which decreases as V_2 approaches zero in order to provide a smooth finish. The final dimension is controlled entirely by the gage output, which automatically retracts the grinding wheel when the desired size is reached.

This type of automatic control may be readily applied to any machining operation where the work can be continuously and accurately measured, and is economically justified if the advantages of speed and uniformity of finished pieces outweigh the initial investment.

Servos for Inspection Work

Servomechanisms are also beginning to play an important part in the inspection of finished work, particularly when a permanent indisputable record of results is desired. Here, the piece to be checked is compared against an accurate master, and the error between them is automatically recorded on a greatly magnified scale. Figure 2 shows a typical example in schematic form, where the radii of two cams are compared and plotted against angular rotation. One cam follower rotates the housing of a transducer while the other rotates its shaft, to develop a voltage proportional to the difference in cam heights. This voltage is compared with the output of a second transducer mechanically connected to a recording pen, to form an error signal which is amplified to drive the pen. Varying the excitation voltage applied to the first transducer will expand or compress the scale, and give any value of sensitivity desired within the accuracy range of components used. If one cam is accurately measured by any standard method and the deviations from the desired function plotted to the same scale as used in recording, the resulting curve may be used as an overlay on the following records to show the absolute errors in all other cams. Such records are often kept with each piece inspected, as definite proof of its accuracy at all points, and eliminates any need for subsequent checking. The fidelity of the recording servo must be very high to accurately indicate the magnitude of rapidly varying errors while the cams are being rotated.

A similar arrangement may be used to inspect gears, potentiometers and other devices where a point by point check is either inadequate or too time consuming to be economically feasible. In addition, the elimination of all human errors and furnishing of a permanent accuracy record are very important factors in today's methods of automatic precision production.

In application of automatic servo control to certain manufacturing processes, a problem often arises in obtaining stability when there is a time delay between the control and measurement of a particular variable. Some types of thin plastic film, for example, are formed by forcing a fluid through a slit of controllable width onto a rotating drum and into various processing tanks, until the final physical characteristics are obtained. It requires several minutes after the sheet is first formed until it is sufficiently hard to make an accurate measurement of thickness, which must be closely controlled. If the slit width were adjusted directly in accordance with the error in thickness obtained at this later stage, violent over and under-correction would result. However, this may be overcome

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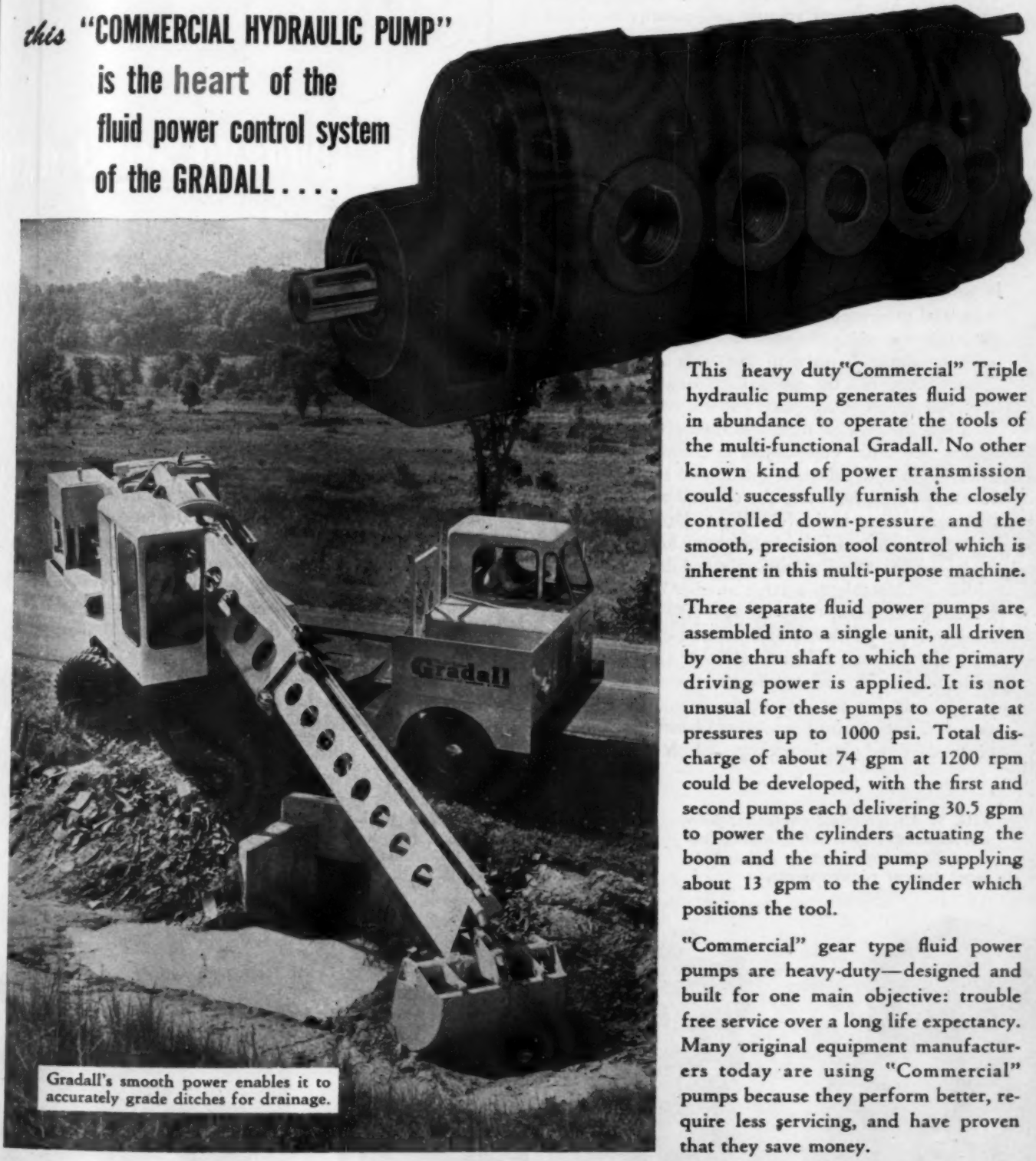

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by using a velocity servo whose rate is proportional to the correction desired, providing the constant of proportionality is such that the rate multiplied by the process time will equal the required change of thickness. A further refinement may be obtained by adding the derivative of measured error to the velocity servo input, with the proper amount and polarity to obtain the final correction in minimum time. Figure 3 shows the basic elements and arrangements for an automatic control of this type.

This sort of problem is common to a great many industrial processes where some desired physical characteristic cannot be accurately determined until some time after the point where it is controlled. The solution now employed usually involves manual adjustment, which introduces a considerable factor of human judgment with its inherent uncertainties.

The aim of the servomechanism engineer should therefore be to remove all uncontrollable factors from industrial processes, and provide the means for a simple automatic routine in each case where it is economically justifiable. In order to do this, he must select and carefully integrate the appropriate components to form a system which is adequate but not over-designed to do a specific job. A wide selection of motors, transducers and other components are now commercially available in hydraulic, pneumatic and electrical forms. In many cases, however, the controller and stabilization means must be individually tailored to meet system requirements. Figure 4 shows one form of electrical controller having adjustable gain and damping factors, which is adaptable to a large number of applications. On the other hand, there are so many possible variations in types and levels of input and output, damping methods, etc. that a universal controller designed to accommodate all such applications would be prohibitive in cost for any one application. The trend has therefore been toward providing elements in the form of standardized plug-in packages which may be readily

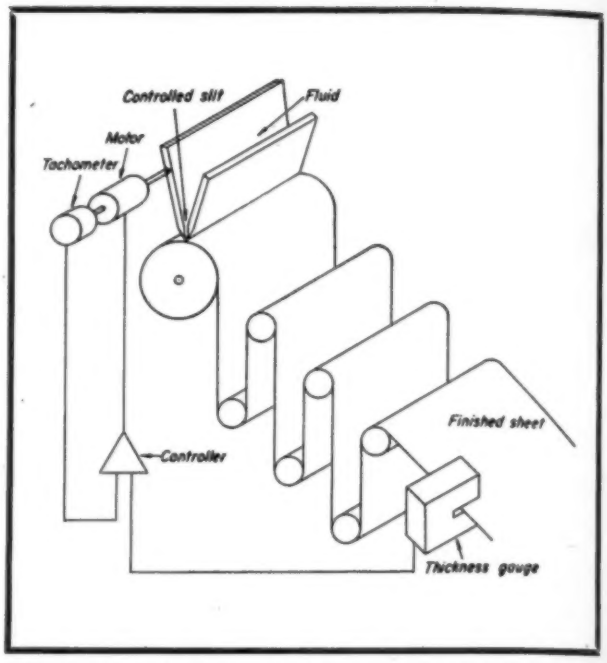

FIG. 3. Control of film thickness is provided by a servo on this industrial process.

combined to make up the desired characteristics of a system. A packaged modulator for handling d-c inputs is shown in Figure 5. Similarly, a pre-amplifier, power amplifier or de-modulator could be added without affecting the basic units, if required. A combination of several typical plug-in assemblies forming a complete servo system is shown in Figure 6.

By selecting the proper components for the application, and combining them with a good deal of ingenuity and experience, servomechanisms can provide the basic control systems for industrial processes. The result will be a major step toward greater efficiency, lower costs and better products in every field of manufacture.

FIG. 4. An electrical controller having adjustable gain and damping factors. Each controller is tailored to meet system requirements.

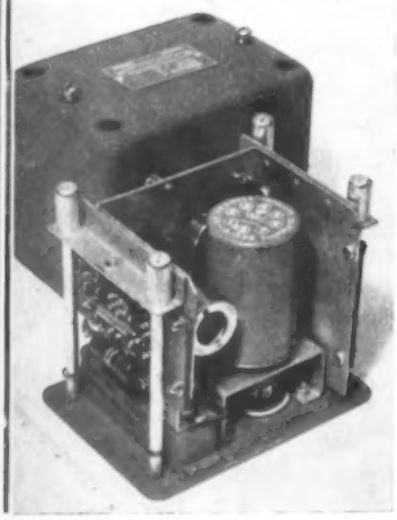

FIG. 5. Standardized plug-in packages, such as this modulator for handling d-c inputs, are combined to form a complete package.

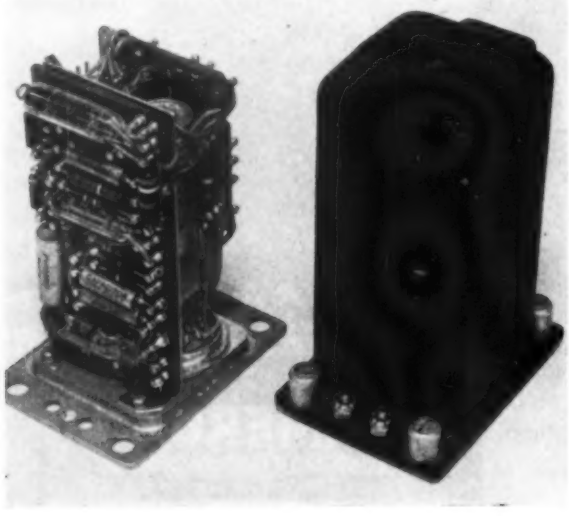

FIG. 6. Several plug-in assemblies make up this complete system to provide desired characteristics for specific servo applications.

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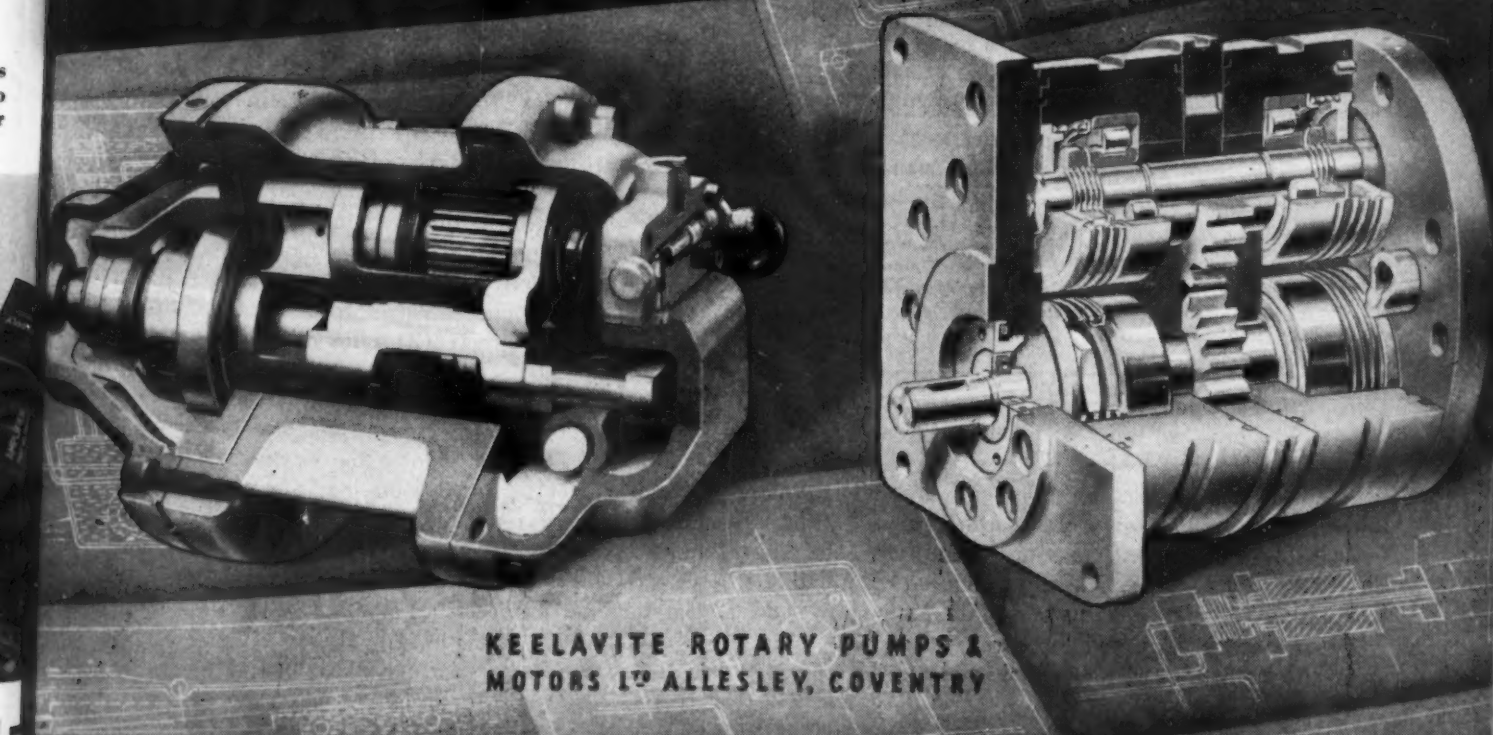

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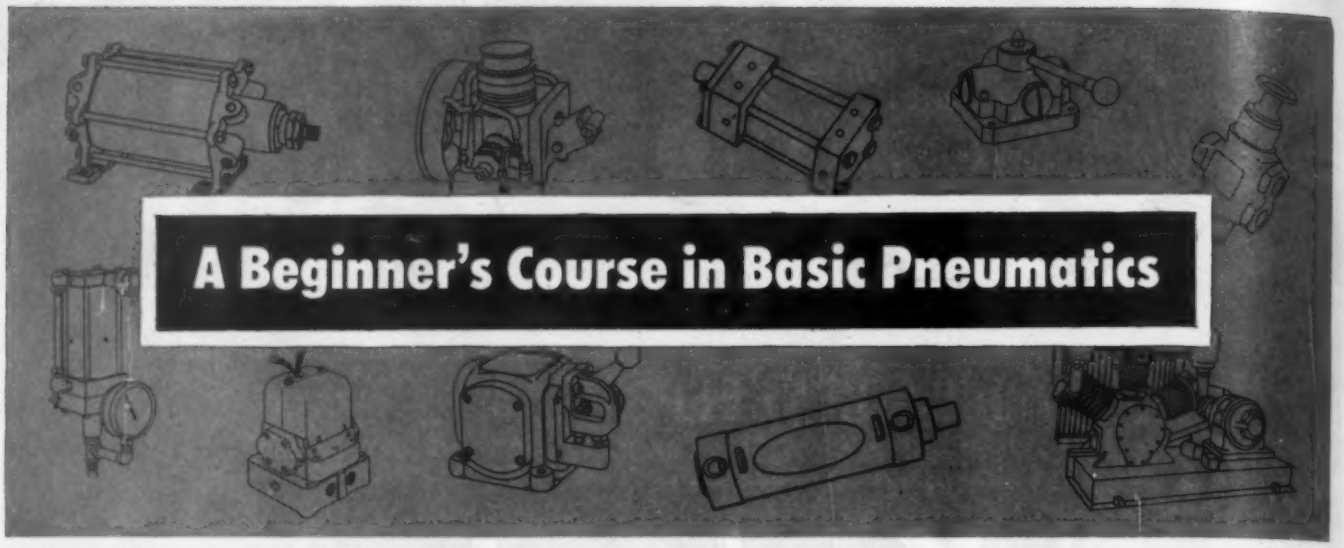

A Beginner's Course in Basic Pneumatics

Sestion III Power and Working Elements

Air Valves

Part 3

Introduction

AIR valves are a distinctive group of mechanical units for the control of flow and pressure of air; they are the means of delivering a specific volume of air to the actuators or cylinders to accomplish specific work. We might define an air valve as a mechanical device whose parts are arranged to control the path of flow of air or to regulate the volume or pressure of such flow.

Distinctive type of valves are found in other fields. Steam, low pressure water, fuels, viscous fluids, emulsions and mixtures containing various amounts of solids all require distinctive types of valves. While some types of construction in valves permit the use of air or low pressure water or oil, we will confine ourselves to the valves which are distinctive for air. Further, we will not treat high pressure air valves but confine ourselves to valves for operation up to 150 psi.

In the September installment discussing cushioning methods for air cylinders, Figures 2 and 3 were made available by the Galland-Henning Manufacturing Company. These photographs showed the design of self-regulating and adjustable cushions.

The most important function of air valves is the delivery of air for the proper functioning of a double acting air cylinder. For this reason the basic valve is a four-way valve. Two and three-way valves have their definite applications both as basic and as pilot operating valves. Another general characteristic is that air valves are small. Air valves with port sizes of 1/4, 3/8, 1/2 and 3/4 inches are, by far, the most common. Some sizes of 1 and 1-1/4 inch are standard for some types of basic valves. Larger sizes are rarely used.

Classifications of Air Valves

Air valves may be classified by (1) basic construction or design; (2) methods of operation; and (3) by function.

There are two basic types of air valve construction, the poppet and the piston. The principal variations are the sliding sleeve, the disc and the diaphragm. These types of construction will be discussed in detail in later installments.

Air valves may be classified by the method of operation as: (1) direct; (2) pilot operated; and (3) solenoid operated. These also will be treated in detail later.

Classification by function is not very accurate in some cases. However, due to the established practice of some manufacturers of naming valves by the function they perform, i.e., speed control, sequence or quick exhaust, reference to function will be made as various types are considered. A general functional classification has been set up in the annual January Directory issue of APPLIED HYDRAULICS.

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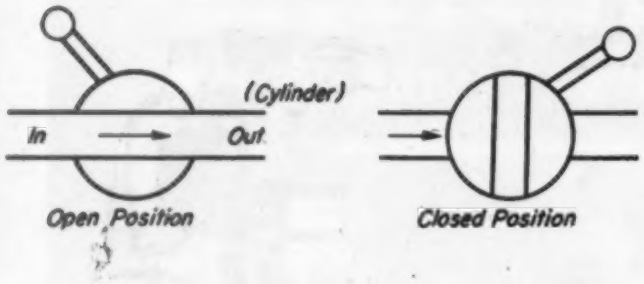


FIG. 1A. SCHEMATIC of a two-way valve.

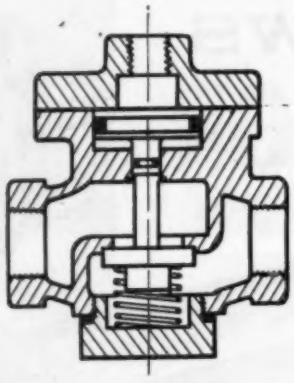


FIG. 1B. A POPPET type straight-way (two-way) line mounted master valve, normally closed operation.

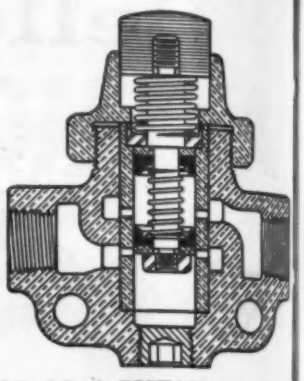
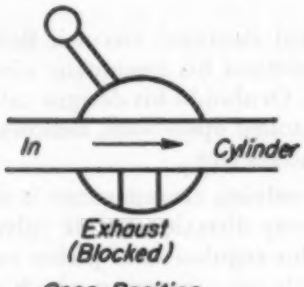


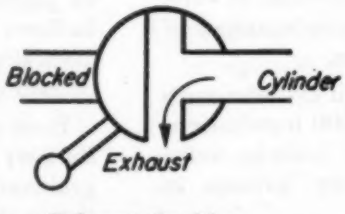
FIG. 1C. A PISTON type, three port valve used as a two-way valve by blocking the center port.

we might divide air valves into three groups: (1) directional; (2) flow control; and (3) pressure control valves.

The directional control group contains valves whose function is to provide one or more flow paths for the operation of actuators or cylinders. A simple approach to directional valves is to distinguish various types by the number of working ports. For our introduction to these valves we can cover the majority of valves in this group by briefly describing and illustrating the two-, three- and four-way directional air valves.

The simplest valve is the two-way, with inlet and outlet ports. Air passes through the valve when the poppet or piston is moved to open a passage; air is blocked off when the poppet or piston is in position to close the passage. Used primarily to open or close an air supply line or for use as a pilot operating valve, those valves are used to control the flow of air in a line where the flow is in one direction only. It is a rather common practice to use a three-way valve, with one port blocked as a two-way valve. Figure 1 shows the schematic of a two-way valve and examples of two-way valves available in lines of manufacturers of air valves. Fig. 1b shows a poppet type valve or straightway valve. Two of this type valve are often used in a circuit, rather than one three-way, for reasons of safety or for obtaining "positioning" control of a cylinder. Figure 1c shows a piston type three





Illustrations used in this article were supplied by the following manufacturers: Hanna Engineering Works, Hannifin Corporation, Logansport Machine Co., Inc., Ross Operating Valve Co., Valvair Corporation.

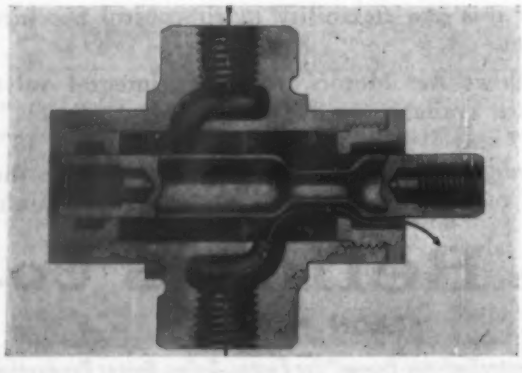
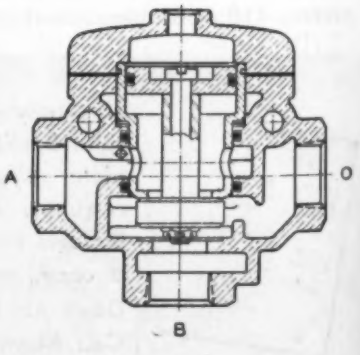


FIG. 2A. SCHEMATIC of a three-way valve.

FIG. 2B. PATH of air flow through a three-way valve in the exhaust position.

FIG. 2C. A POPPET type three-way master valve, with solenoid operated pilot valve. For normally closed operation A is the inlet, B the exhaust and O the cylinder ports. For normally open operation B is the inlet and A is the exhaust port.



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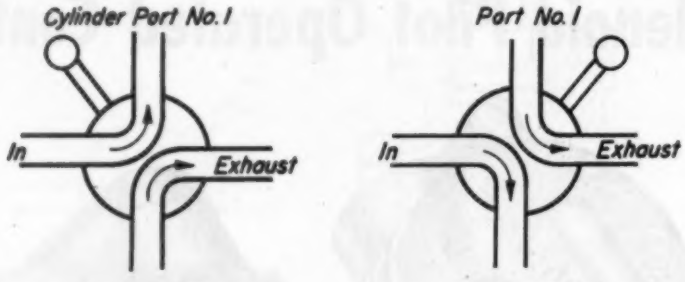

FIG. 3A. SCHEMATIC of a four-way, two position valve.

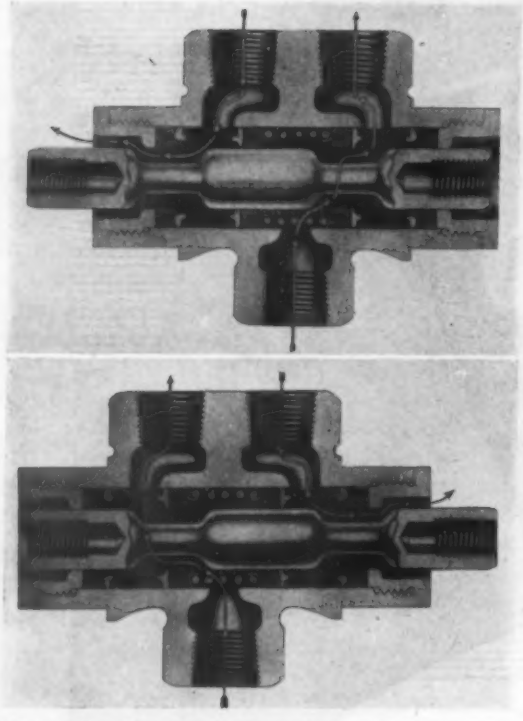

FIG. 3B. PATH of flow through a four-way valve in the open and exhaust positions.

FIG. 3C. An exploded view of a disc type valve for three- or four-way operation.

port valve with one port blocked to function as a two-way valve. This specific valve is used for remote control of bleeder and pilot operated master valves and for the control of single acting air cylinders.

A three-way air valve is one that has three ports: an inlet port, a delivery port (most commonly called cylinder port) and an exhaust port. The arrangement is that two ports are open and the third blocked. In one position inlet and cylinder ports are open and the exhaust port is blocked, in the other position the inlet port is blocked and cylinder and exhaust ports are open. This type could be used to control a single acting cylinder, provided the valve has a neutral position. The three-way valve is much more common than the two-way. It is used as master valves that are pilot operated, as pilot valves and for direct control of small cylinders.

The four-way air valve, two position valve is the basic type used to control a double acting air cylinder and is the most commonly used. Essentially the four-way valve is a combination of two three-way valves. They have a common inlet port and generally have a common exhaust port. The other two ports are the cylinder ports. When a valve is supplied with different supply or inlet ports we have a five-way valve. The four and five-way valves are used for the control of two separate air lines, using only one handle, pedal or other actuating means. In addition to the control of one double acting cylinder, the four-way air valve may be used to control two single acting cylinders.

The introduction to air valves is completed in the next installment with typical examples of basic types of construction and methods of operation.

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4000 psi Hydraulic Circuit Designed for British Airlines

By John A. Lankester

THE Bristol Britannia, one of Britain's newest airliners now in the early stages of production, provides an interesting example of a high-pressure hydraulic system, several of which have been developed in the U.K. during the last few years. The aircraft itself is powered by four propeller turbines, the two inboard engines each driving a pair of hydraulic pumps from their auxiliary gear-boxes. These axial piston pumps are of the swash-plate type and each delivers 3 gallons per minute (U.S.) at 2500 rpm at a pressure of 4,000 psi. The total of 12 gpm feeding the small high-power jack cylinders made possible by the use of 4,000 psi gives a rapid rate of landing gear detraction, the time for raising being only 12 seconds and that for lowering 14 seconds.

Not only does the use of high pressure permit the use of comparatively small jacks to handle the loads involved, but also, since their capacity is small, smaller bore piping can be used. In fact the largest pipes in this system are only ½ inch diameter while many of the subsidiary services are connected with ⅜ inch tubing. It follows, therefore, that smaller, lighter valves than those necessary for a low-pressure-high-delivery system can be used. This is an important consideration in a commercial aircraft whose payload is the key to economic operation. By using electrical actuation of selector valves the actual piping runs to the pilot's station have been minimized.

Many opponents of high-pressure hydraulics frequently object that such systems are more liable to give leakage trouble than those operating at pressures between 1,000 and 1500 psi. British Messier claim to have pioneered the 4,000 psi. system and to have done all the development work, and this company is confident that the problem of leakage of seals has been successfully solved.

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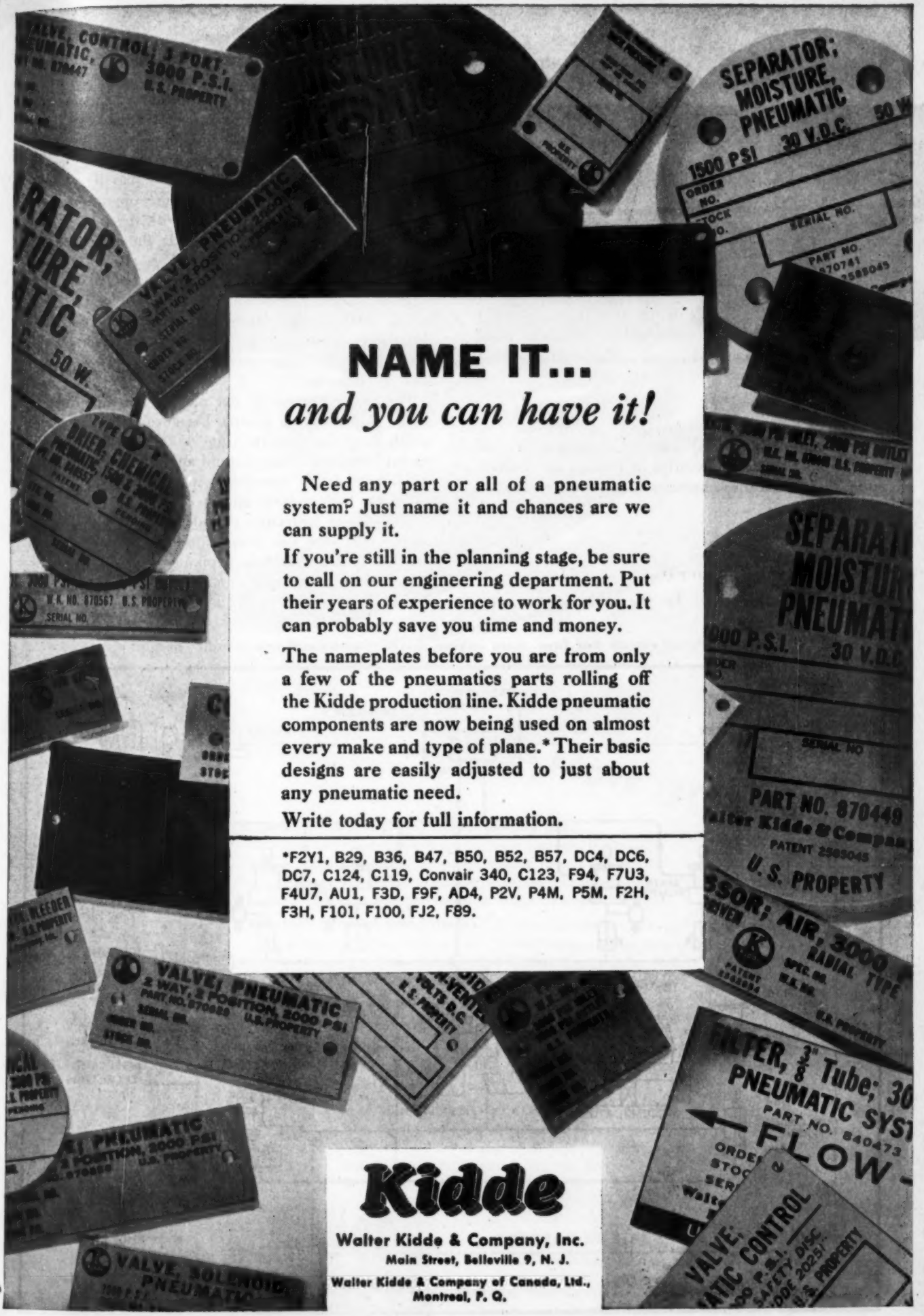

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air circulation, electrical wiring or components, or passenger's baggage; any drips or leakage are drained from these envelopes harmlessly to the exterior of the aircraft.

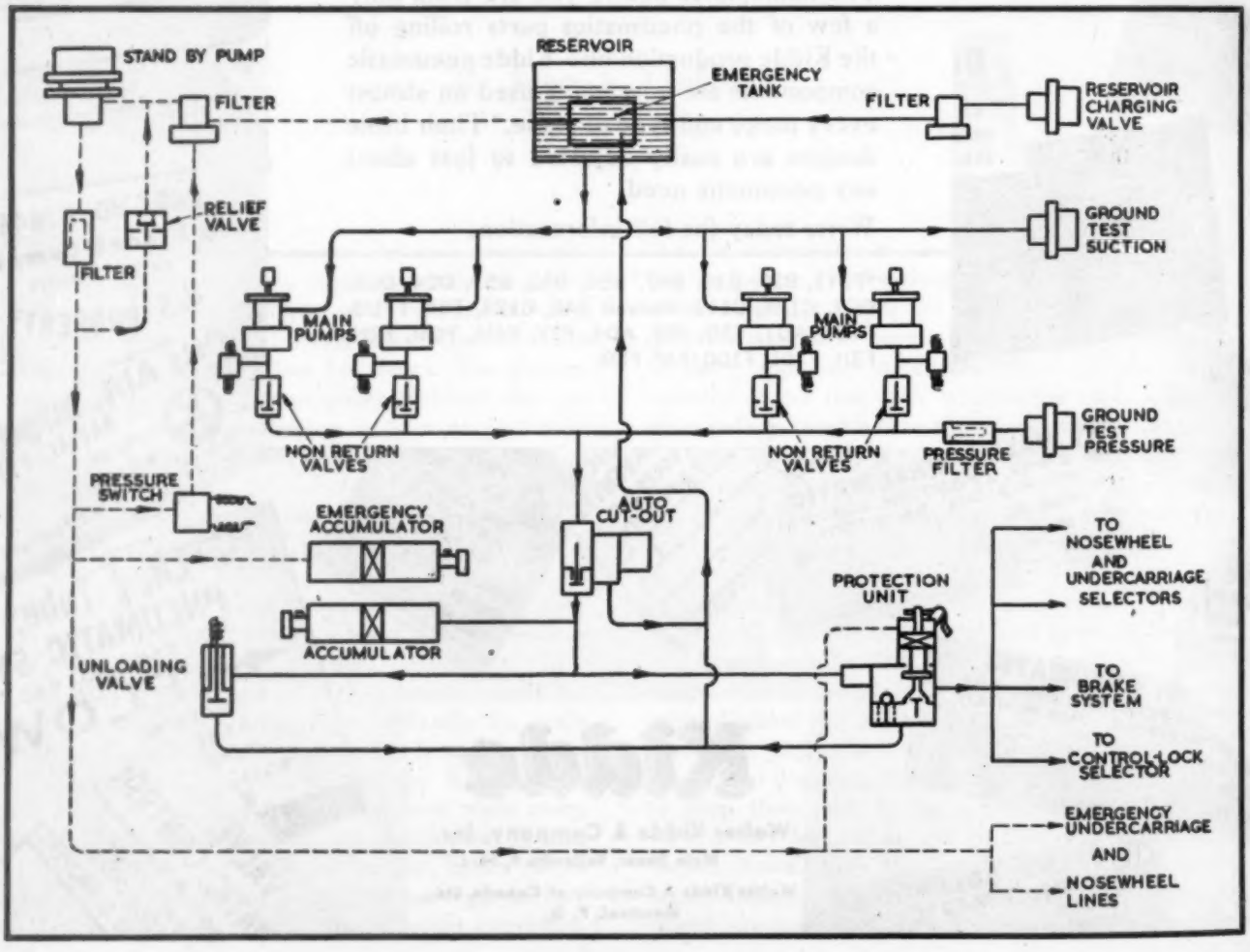
Main System Services

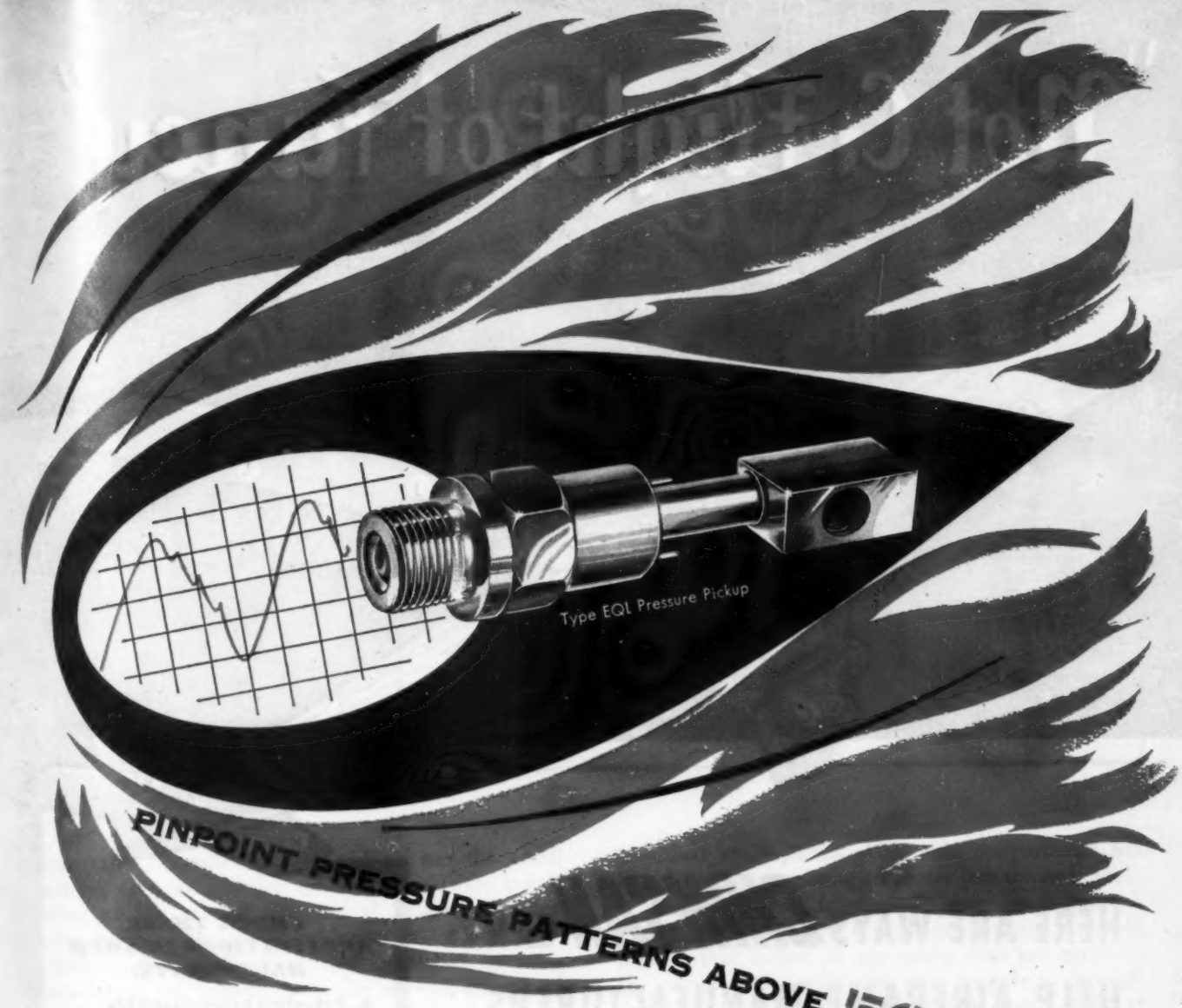
The services operated by the main system are: Retraction and extension of the landing gear; wheel brakes; locking of the flight control surfaces when the aircraft is parked; and power assistance for the nosewheel steering. A noteworthy feature of the landing gear is the rotation (by hydraulic means) of the wheel-bogies from their position at right angles to the shock struts into an altitude where they be parallel to these members. This bogie-folding operation must of course be correctly sequenced with the raising and lowering of the legs so as to clear the landing gear fairing-doors and this of necessity is an added complication to this part of the circuit. However, the rotation of the bogies enables them to be retracted into a much smaller space than otherwise, so the additional hydraulic service is more than offset by the advantages of compactness and space saved when the legs are retracted.

The brake systems do not require the full pressure of the engine driven pumps. Pressure reducing valves which drop the pressure from 4,000 to 1,500 psi are placed between the main circuit and the brakes systems. An independently operated windshield wiper is provided for both captain and second pilot.

The use of hydraulic cylinders to lock the flying control surfaces has been initiated by the aircraft builders and it should be explained that this is necessary because the flight controls of this aircraft are actuated by servo-tabs. Thus there is no mechanical

FIG. 1. Power circuit has four main engine driven pumps and one standby pump.





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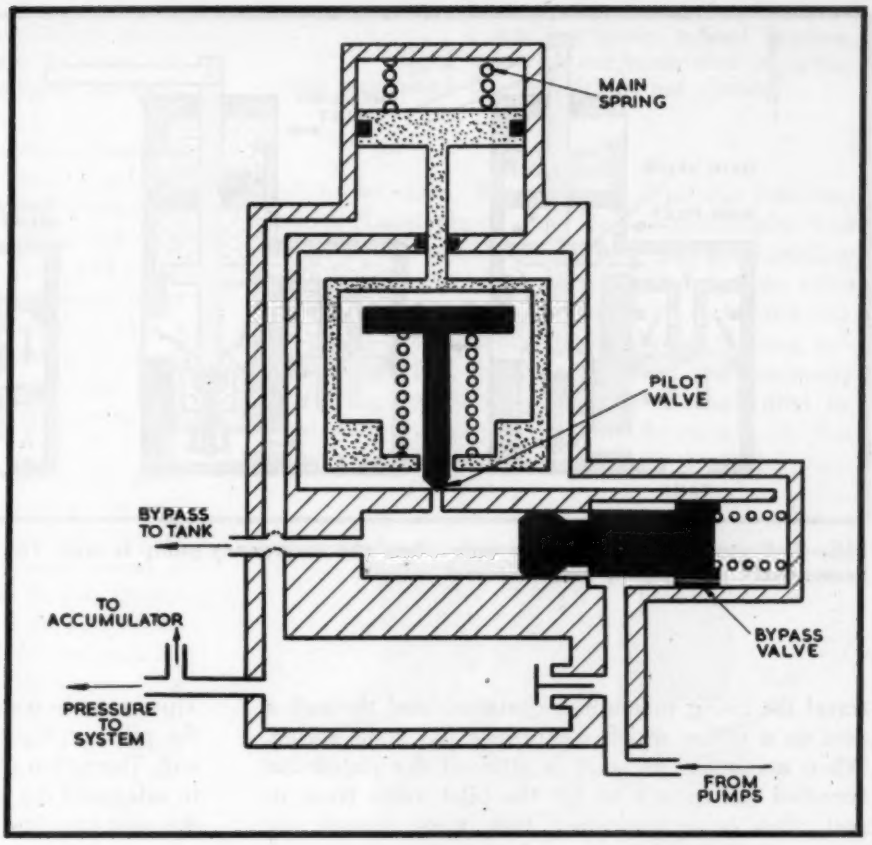


FIG. 2. Diagram of the automatic cut-out valve. This valve acts to protect the pumps and system from overload.

connection between the pilot's column and the actual moving surfaces. For this reason if these were locked when on the ground by external fixtures, attached after parking, they could inadvertently be left in position before take-off without the pilot feeling anything unusual on his column, with the obvious danger of starting the run with locked surfaces. By the use of built-in hydraulic control locks, interconnected with the engines so that it is impossible to open up the throttles without first unlocking the controls, this haard has been eliminated.

The Power Supply Circuit

In examining a fairly extensive system such as this it is undoubtedly much simpler and more convenient to consider each circuit separately and, before looking into the details of the various services, it is first appropriate to explain the power circuit, Figure 1.

This comprises the four main pumps, automatic cut-out valve and the protection unit. This latter combines the duties of isolating the main power circuit when the emergency pump is used and releasing fluid from the landing gear cylinders; it also deals with excessive pressures due to thermal expansion or in the event of automatic cut-out failure.

The pumps are fed from the reservoir, which can be filled from a hand pump via a ground charging connector, having a capacity of 7.6 gallons. This reservoir also contains, in a separate compartment, the emergency supply of 3 gallons (U. S.) of oil. All returning fluid enters the main tank through the emergency compartment to automatically keep it replenished at all times. After this compartment has been filled the remaining oil passes into the main tank.

Pressure outlets from each pump pass through non-return valves into a common pressure manifold pipe so that failure of any pump does not result in the output of the remaining ones by-passing through the faulty one back to return. Each pump outlet is also equipped with a pressure switch for illuminating an indicator lamp in the cockpit showing that the pump is operating satisfactorily.

The pump contains seven axially disposed cylinders and pistons, the latter being moved through the expulsion stroke by a swash-plate and returned through the intake stroke by compression springs.

The pressure manifold takes the main oil feed to the automatic cut-out valves, which, on completion of any service, by-passes the delivery back to tank when the system pressure reaches 4,000 psi: power feed is resumed when this falls to 3,500 psi. A hydraulic accumulator is piped into the pressure line between the cut-out and the main system and this is charged to 2,500 psi compressed air initially which rises, of course, to 4,000 psi with the system pressure.

Automatic Cut-Out Operation

The cut-out valve, Figure 2, contains by-pass valve, main spring, pilot valve, and, in the outlet to system side, a non-return valve. During the operation of any service, pressure is applied through a small drilled hole in the head of the by-pass valve so that the pump pressure keeps the by-pass closed, thus forcing the fluid to the selected service. On completion of cylinder

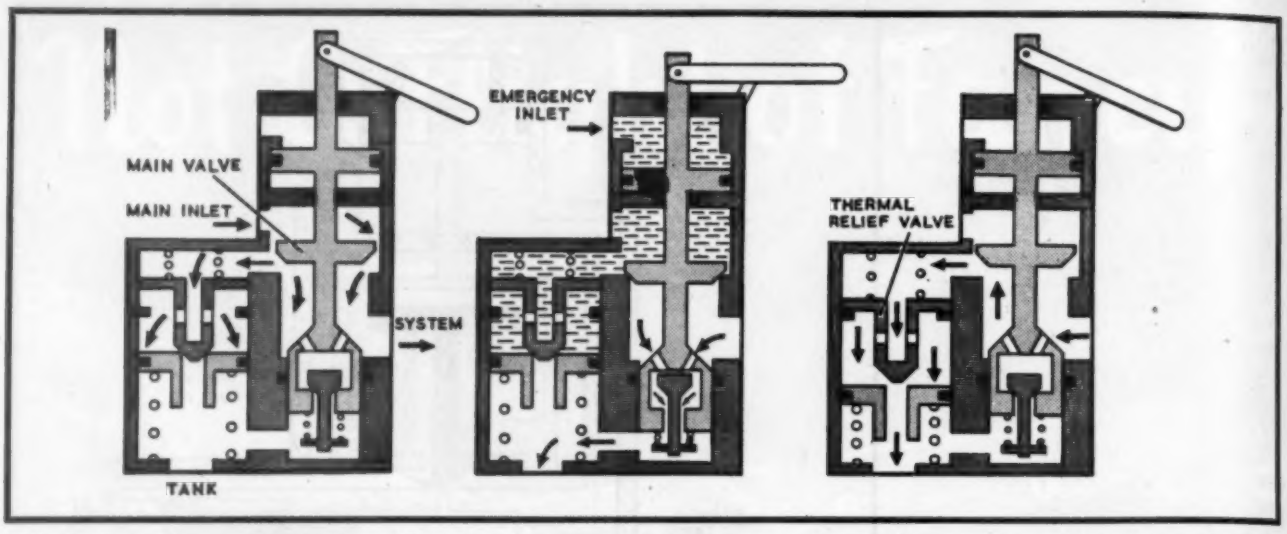


FIG. 3. Protection unit operates only when the emergency pump is used. The three positions show: "normal flow", "emergency operation", and "thermal relief".

travel the rising pressure is communicated through a port to a piston which compresses the main spring. When maximum pressure is attained the piston has travelled far enough to lift the pilot valve from its seat. This is so positioned that, when opened, the pressure behind the by-pass valve can escape to return. This causes a pressure-drop at the back of the by-pass valve which allows the latter to lift from its seat, switching the pump delivery back to reservoir. As this unloading takes place the outlet non-return valve closes to hold the main spring in the compressed condition and retain the pressure in the system and in the accumulator.

When this pressure drops to 3,500 psi the main spring forces the pilot valve to resume its previous position equalizing the former differential pressure on the by-pass valve which therefore closes assisted by its spring. The pump output is thereby directed once more into the main system opening the outlet non-return valve on its way to the newly selected service.

One of the main characteristics of this unit, to which considerable attention has been paid, is the smoothness and silence of its working. On a test rig a cut-out valve was observed undergoing an endurance test operating under conditions of severe artificial leakage, arranged to cause it to cut in and out at a frequency of 2 cycles per second with a discharged accumulator. It was particularly interesting to note that after more than 10,000 cycles a positive action was maintained without chattering or oscillation, neither was any undue wear apparent. That the main spring had stood up well to such an arduous test was indicated by the consistent accuracy of both "cut-out" and "cut-in" pressures.

From this description it can be deduced that the main system would be held at full pressure during the time of flight although the pumps were in the by-passing condition. However, to safeguard the circuit from protracted periods of full pressure, an unloading valve is incorporated in addition to the cut-out. This is an electrically actuated two-way valve by which the pilot or flight engineer can unload the pumps at will. The action of the cut-out valve therefore is purely to safeguard the pumps and system automatically until the pilot has time to spare for operating the unloading valve switch opening the main system, as well as the pumps, back to reservoir.

Protection Valve Unit

The next component in the power circuit is the protection unit, Figure 3, which comes into play only when the emergency pump is used. When this is done a branch of the emergency pressure line feeds oil to a sliding piston which moves a shuttle. This closes a valve to isolate the main pumps supply line from the rest of the system; at the same time this shuttle also opens another valve to port the rest of the system to reservoir. This arrangement ensures that the landing gear can be lowered even though the main selector valve may have jammed in the "up" position.

The left side of the diagram shows the pressure relief valve housed in the protection unit as an additional safeguard against cut-out failure or thermal expansion.

The emergency pump is controlled by a pressure switch which opens the electric motor circuit when full pressure has been reached; the motorized pump is switched on again when the pressure falls to 3,500 psi. It should be noted that all emergency pipe lines are entirely separate from the normal ones. The landing gear cylinders, up-locks, and their shuttle valves are the only components common to both systems.

Reverting to the point mentioned about the emergency lowering of the landing gear although the selector may have jammed in the up position, it is apparent that, in such a case, however unlikely, the first thing to be done after landing is to get the selector into the "down" position. Otherwise, when the protection unit has been reset, starting up the engines would lead to the folding of the gear with the aircraft

standing on it. For this reason the protection unit is fitted with a hand lever which cannot be reset into the normal position until the gear selector has been moved into "down."

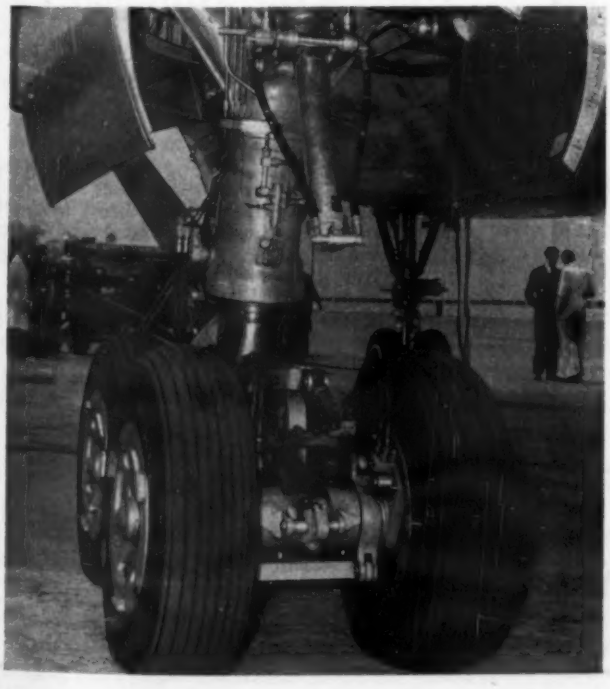
A handpump and ground test connections complete the power circuit. The hand pump feeds a selector which can direct the oil either to normal or stand-by systems for the purpose of pressure testing either of these. In the unlikely event of both normal and emergency power supplies failing, it is possible to lower the landing gear by the hand pump, but this takes a long time and would seldom, if ever, have to be done. For purposes of clarity, this hand pump has been omitted from the accompanying power circuit diagram.

Before leaving the power circuit there is one more unusual component of interest. This concerns the feed from the reservoir to the main pumps and the method employed to ensure that a constant pressure head is maintained from tank to pumps. This device, known as the jet-pump, operates by feeding a portion of the return oil through a jet surrounded by an annular space which is open to the reservoir. By means of a restrictor the pressure at the jet is maintained at 40 psi which gives sufficient venturi effect to draw in oil from the tank at a rate of not less than ½ gallon per minute. This supercharges the pump intake connections to a pressure of 10 psi and thus eliminates cavitation effect or pump starvation at altitudes above 20,000 feet.

The Landing Gear Circuit

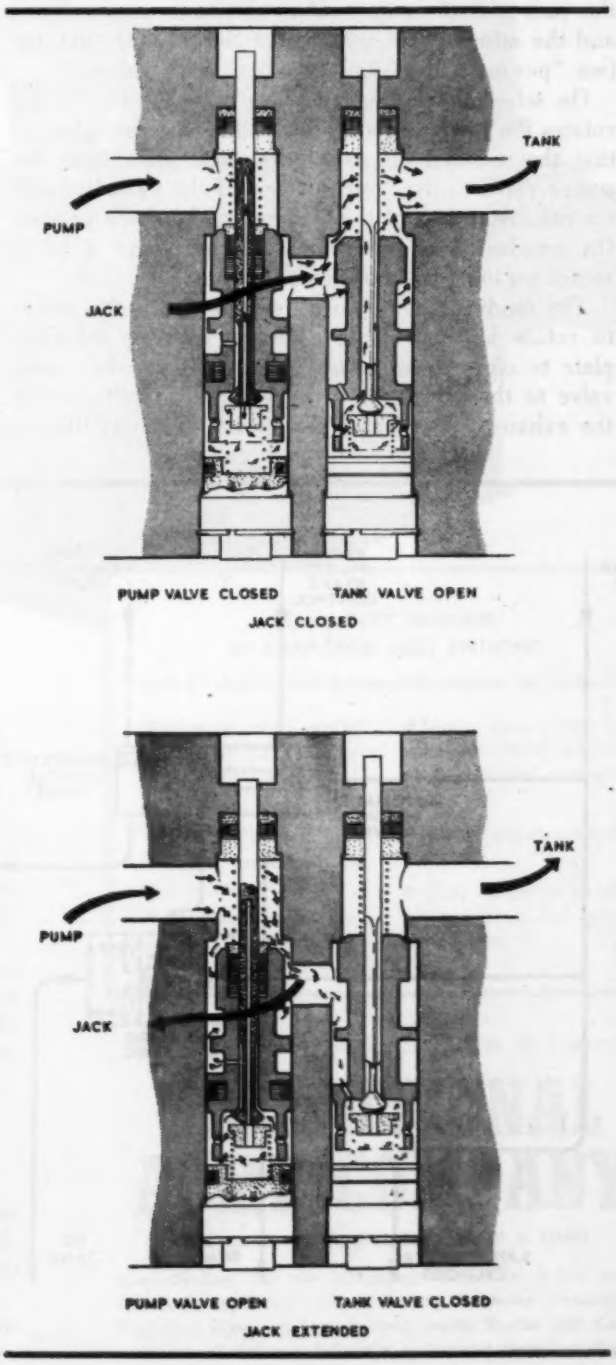
When the aircraft becomes airborne the extending of the shock-struts closes a safety switch in the selector circuit which permits the selection of landing gear

FIG. 4. Control valving for the landing gear. Photograph shows the main land gear. The four wheeled bogie is carried by the oleo-pneumatic shock strut.



. . . landing gear, wheel brakes, flight control surfaces and steering are operated by the 4000 psi system . . .

"up" to be made. When this is done the following sequence takes place: (1) Main wheel bogies fold into a position parallel to the oleo-pneumatic landing legs; when this has been completed a sequence valve relays oil to (2) disengage the down locks and (3) pass oil to the underside of the main retracting cylinders which fold the gear upwards and rearwards into the engines nacelles where they are secured by spring loaded latch-locks. Simultaneously with this selection the brakes are automatically applied to stop



the wheels spinning before reaction takes place. The folding of the bogies prior to retraction enables the gear to be stowed in a much smaller space than would be necessary if the bogie-arms remained at right angles to the shock-struts.

The directional selector valves used for this service are of an interesting design embodying electrical actuation initiated by a switch at the pilot's station. The electric actuation is not by means of the familiar solenoids but by a small reversible electric motor. The motor drives a lead screw through a 36 to 1 reduction gear; the lead screw moves a plate carrying two pairs of cams for opening the two pairs of poppet valves. Each pair of valves is ported to each end of the jack cylinders, one valve admitting pressure oil, and the other return oil, so that the selector contains two "power" valves and two "exhaust" valves.

On selecting landing gear "up" the electric motor rotates the screw threads which slides the cam-plate so that the inclined planes of the cams push open the power valve to the "retract" end of the cylinders and the exhaust valves of the "extend" side of the pistons. On conclusion of the cam-plate movement a limit-switch on the lead screw cuts the motor.

The landing gear "down" switch causes the motor to rotate in the reverse direction moving the cam-plate to close these valves and then open the power valve to the top of the cylinders and simultaneously the exhaust valve from the bottom of the cylinders; another limit switch then cuts the motor.

A particular feature of the selector is the manner in which the problem of stopping the electric motor in the right place has been solved; this has always been a difficulty where motors are used for "spot-on" positioning purposes. In this instance the nut in which the lead screw runs is so arranged that, at the correct position, it runs off the thread of the screw thus instantly stopping the linear traverse at the point where the valves are correctly set, yet allowing the motor to run on without damage. The threads of both screw and nut are so arranged that, when the selector motor is reversed, the nut immediately picks up again on the lead screw, the re-engagement of the mating threads being ensured by light springs. This ingenious arrangements, as will be seen from the accompanying diagram, ensures correct actuation of the valves, without the necessity of breaking the motor or otherwise arresting its rotation when the required point of cam-plate travel has been reached. Also, any failure of a limit switch (or pilot-operated switch) cannot harm either motor, screw threads, or valve gear, all of which are safeguarded by the ability of the motor to overrun in the manner shown.

The actual movement of the main valves themselves is by servo action, which can be followed on the diagram. Taking the jack extended illustration, Figure 4, it can be seen that the pilot valve in the center of the left hand (pump) valve is open ducting the balancing pressure beneath the main valve assembly to return: the pump pressure will therefore open the main valve and pass out to the jack, while exerting a

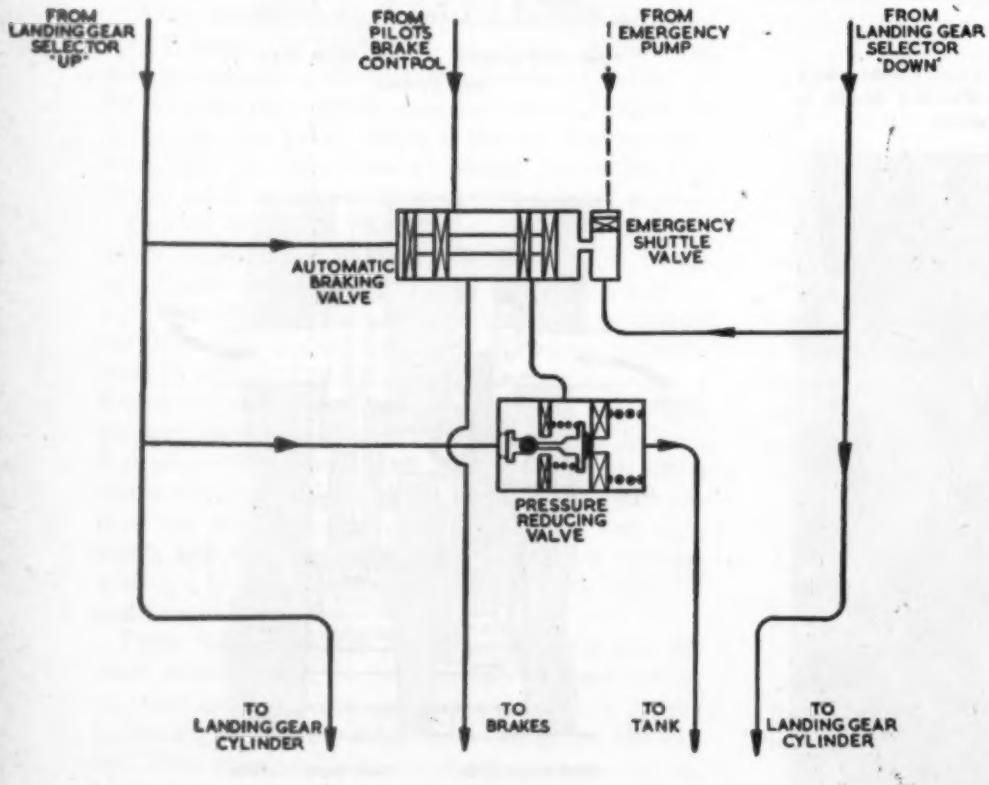


FIG. 5. Automatic braking circuit.

The braking of the wheels automatically prior to retraction is brought about by taking a branch from the landing gear "up" pipe through a pressure reducing valve to a transfer valve housing a spool to open appropriate ports. Another branch of this line also feeds the transfer valve direct without passing through the reducer. When pressure is applied to raise the legs it also moves the spool into a position in which the reduced-pressure branch is ported to the brakes automatically without any action on the part of the pilot. Selection of landing gear "down" slides the spool back to a position where the pilot's brake control valve is once more connected to the brake systems in the normal way.

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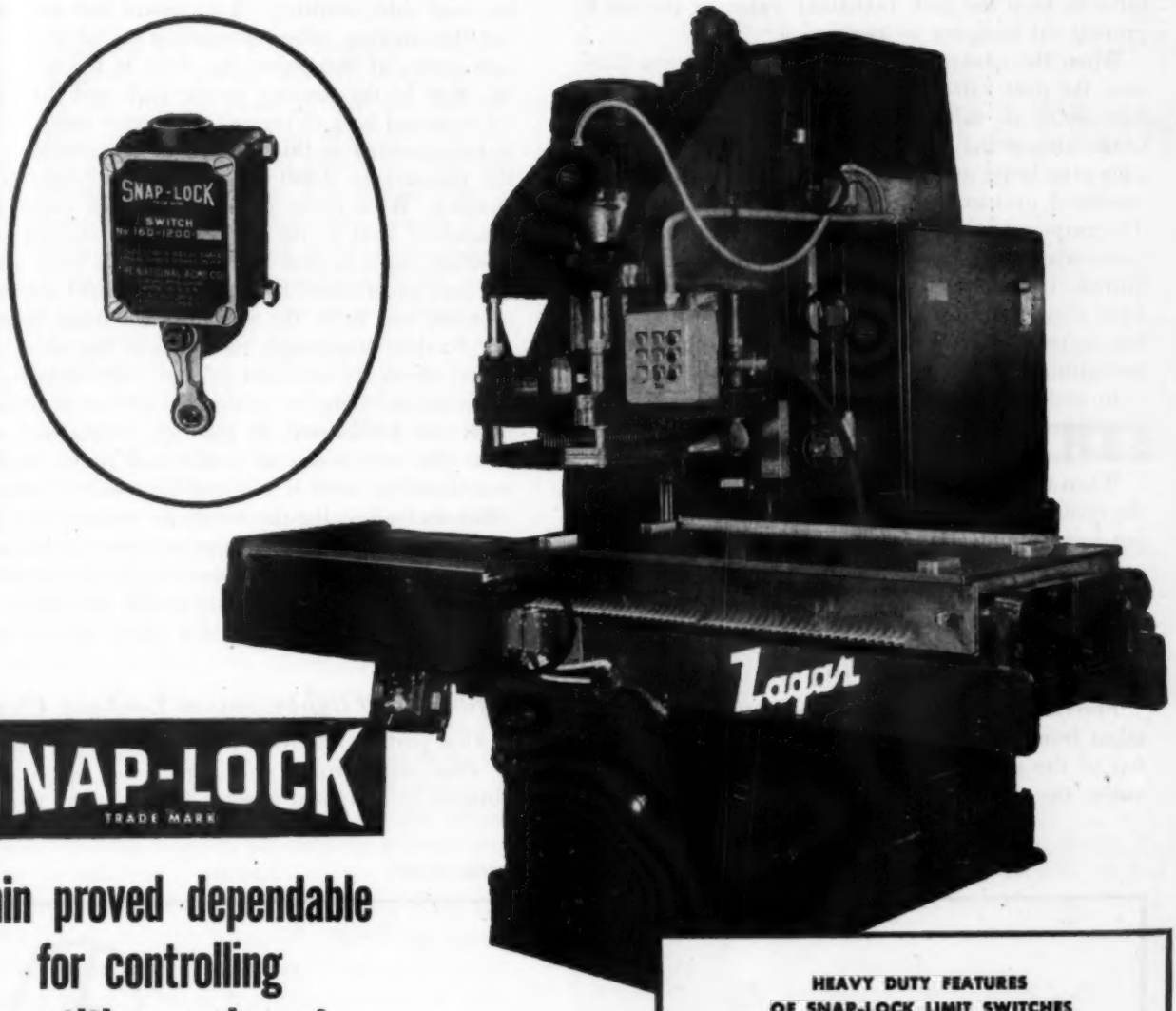

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force to keep the tank (exhaust) valve on its seat to prevent oil escaping to reservoir.

When the cam-plate is moved to the reverse position, the pilot valve re-seats, the pump pressure therefore exerts its influence through the central drilling to the area at the bottom of the main valve assembly. This area being greater than that of the valve seat, the equalized pressure ensures the shutting of the valve. The purpose of the pilot valves, then, is to set the pressure balance, or upset it, on the main valves as required. There is no intermediate or neutral setting. This servo arrangement keeps the operating loads low, so reducing wear on the cam-plate mechanism and permitting low power electric motors to be used.

In order to minimize the piping forward to the nosewheel two of these selectors are fitted, one coupled to the main legs, and the other to the nosewheel.

When the landing gear selector is moved to "down" the reverse sequence of operations to raising is started, but first the uplocks are released by a small hydraulic cylinder fitted for the purpose; when finally lowered the legs are locked down by internal locking mechanism housed inside the radius rods.

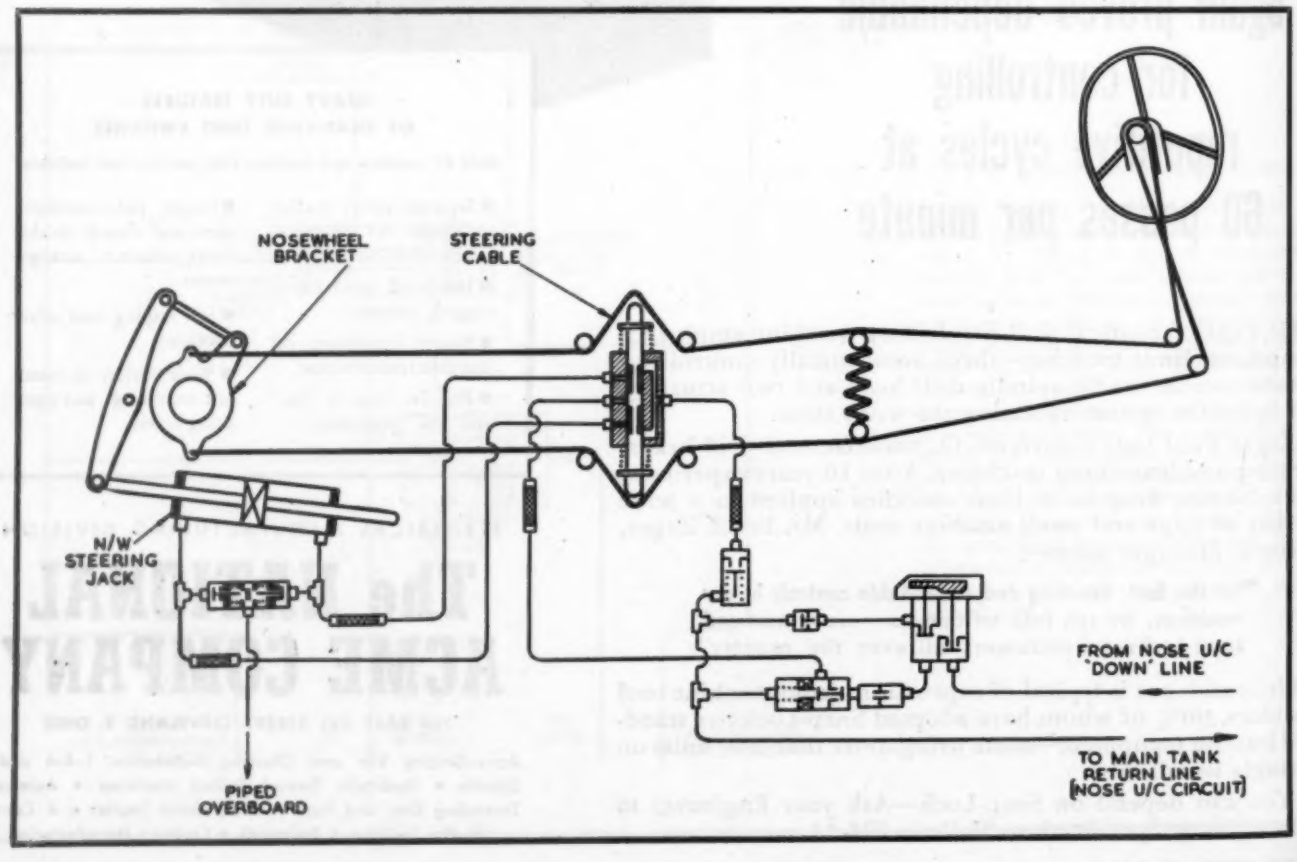
Power Assisted Steering

Pressure feed for the power steering, Figure 6, is taken from the pipe from the nosewheel selector to the top of the nosewheel retracting cylinder since, obviously, the power steering is only required when the gear is extended. This feed goes first to an electrically controlled two-way valve; when the pilot grips the steering control handle a grip-switch energizes this two-way valve shutting off its return line and supplying the steering valve. According to the position, or movement, of this valve, the fluid is fed to one side or other of the steering power jack and the exhaust oil is passed back to return. A pressure reducing valve is incorporated in this portion of the system to drop the pressure to 2,000 psi which is sufficient for the steering. Wire cable follow-up linkage connects the nosewheel strut to the pilot's steering control via the steering valve so that when the wheels have assumed the position dictated by the pilot's control the valve is centered and holds the steering jack there. A pair of relief valves intercouple the pipes to the steering cylinder; these are installed to deal with excessive pressures which might be created should one tire burst or otherwise be deflated on landing. Under such conditions the nosewheel unit would kick round rapidly in one direction until it reached the position where the offset-set load on the tire would be compensated by the twisting action of the tire running skew on the runway. The steering valve also houses a valve to interconnect both sides of the cylinder to enable the wheel to be free to steer in any direction when the aircraft is being towed.

Hydraulic Flight-Control Locking Circuit

This part of the system is comparatively simple as it does not involve any sequencing operations; it consists of a manual selector fed from the power cir-

FIG. 6. Power steering circuit.



cuit and by an accumulator of 40 cu ins capacity initially charged to 2500 psi air pressure. This latter ensures that the control surfaces remain locked when the engines are shut down and also takes care of expansion or contraction of fluid under varying temperatures.

From the selector the feed pipes distribute pressure oil to either end of five locking jack cylinders, one for each aileron, two for the elevators and one for the rudder. Within each cylinder is an axial rod passing right through its center line and projecting through the end fittings of the cylinders. This rod is free to slide in unison to the control surface to which it is attached. Surrounding this sliding rod are two piston-heads carrying sleeve-tubes concentric with the rod; these tubes are glanded where they emerge from the cylinder barrel. With the application of pressure at the middle connection of the cylinder the piston-sleeve assemblies move apart and the ends of the tubes butt against the flanges provided on the sliding rod thus carrying the rod, and with it the control surface, into the neutral position where it is held by accumulator pressure. When the selector is moved to the unlocked position the pressure is applied at the extremities of the cylinder forcing the pistons and their sleeves inwards so freeing the sliding rod and control surface for normal use. As has been mentioned above, this selection must be made before the throttles can be opened up for take-off. The supply line of this service carries a non-return valve to support the pressure in the accumulator when the rest of the system is at zero. To ensure a steady movement of the locking sleeves a variable flow restrictor valve is fitted in the line which restricts the locking flow but provides an unrestricted travel to the unlocked position.

Throughout the whole system provision is made for the filtration of the circulating oil, cleanliness being of special importance in a system where high pressure makes fine clearances in pumps essential to high efficiency. As is customary, flexible hoses are used at many points in the system where vibration or movements make rigid piping unsuitable. In certain places, however, notably the bogie rotation pipes on the main landing legs, flexible hoses have given place to glanded swivel joints. These have been designed by the aircraft manufacturers for installations where the minimum radii of flexible pipes at 4,000 psi cannot be fitted in to suit design requirements.

SAE Aircraft Meetings

The SAE A-1 Committee, Aircraft Pumps, will meet on Tuesday, November 3. The A-3 Committee, Aircraft Valves, Fittings and Flexible Hose Assemblies, will meet on Monday, November 2. The A-6 Committee, Aircraft Hydraulic and Pneumatic Equipment, will meet on Wednesday, Thursday and Friday, November 4-6. All meetings will be at the Statler Hotel, Washington, D. C. All pneumatic items on the A-6 agenda will be taken up on Wednesday; fluids and packings on Thursday and hydraulic items on Friday.

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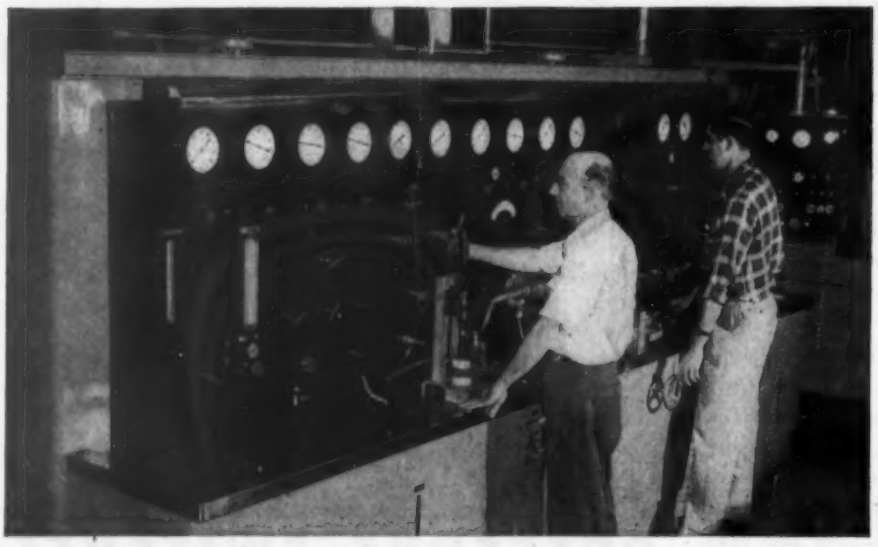
GREER TOPICS

Important News of Aviation & Industrial Test Equipment



Greer Jet Engine Fuel System and Pump Test Stand, shown here in Boeing's Wichita plant, is used to test fuel pumps and fuel system accessories used on the stratojet engines.

How Boeing Checks Stratojets with Greer Test Equipment

The photographs on this page show four typical scenes in Boeing's test department. We could show you dozens more. All these shots have one thing in common. The test equipment shown in use is made by Greer Hydraulics.

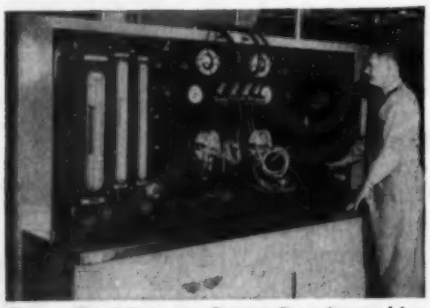
Name any aircraft manufacturer, both here and abroad, and it's ten to one you'll find Greer equipment in their testing operations. The name Greer means accuracy and dependability, the two all-important qualities in test precision equipment.

Pioneers in this field, Greer has standardized its machines until you can order them for most purposes right out of a catalog (yours on request). If your needs call for custom designing, we can do that too.

Greer Portable Hydraulic Test Machine provides hydraulic test fluid for checking hydraulic systems of modern aircraft.

GREER
TEST EQUIPMENT

Greer Hose Tester tests from one to six hose lines or similar production components to pressure of 25,000 psi. Covered burst chamber is provided for safety.



Greer Fuel Booster Pump Stand provides dual sumps and test chambers so run-in and performance testing can be accomplished on two components at one time.

Greer Hydraulics Inc. 454 Eighteenth Street, Brooklyn 15, New York

Field Offices: 1908 West Cermak Road, Chicago, Illinois • 25 South Main Street, Dayton, Ohio
2832 East Grand Boulevard, Detroit, Michigan • and sales representatives in all principal cities

Third Transport Aircraft Hydraulic Conference

THE third Transport Aircraft Hydraulic Conference, sponsored by Vickers Incorporated, will be held at the Park Shelton Hotel, Detroit, on Tuesday and Wednesday, November 3 and 4. Howard Pike, Chief Engineer for National Airlines will act as general chairman of the 1953 meeting.

The 1953 program will cover Transport Aircraft Hydraulic Systems in general, including accessories, tubing, fittings and hydraulic fluids. It is expected that sufficient time has been accumulated on the new Convair 340's and Lockheed 1049's to permit representative discussion of the new hydraulic system features of these aircraft.

Howard Pike, Chief Engineer, National Airlines, General Chairman 1953 Transport Aircraft Hydraulic Conference.

At the 1952 meeting there were 92 participants representing 51 industry organizations. Twenty-five airlines, including nine foreign, were represented by forty people. Three foreign airframe manufacturers and seven domestic airframe manufacturers were represented. Military guests and allied manufacturer representatives also attended.

The third Transport Conference is expected to attract over 100 representatives of the industry.

Fluid Power Circuits for Jet Fighter Planes

THE first twin turbo-jet fighters were contracted for in 1943 when the BuAer of the Navy placed a production order for the McDon-

nell FH-1 Phantom. Steady increase in the use of both hydraulic and pneumatic circuits, typical for all high speed fighters both carrier based (USN) and land based (USAF) can be illustrated by the development of such circuits in the planes of one of the leading airframe manufacturers.

McDonnell's FH-1 Phantom, powered by two Westinghouse 19-XB

FIG. 1. The FH-1 Phantom, first all-jet carrier based fighter was the first to land aboard a carrier. Only one service, the brakes, was hydraulic.

turbo-jets, made its first flight tests in January, 1945. This airplane, Figure 1, was the first all-jet, carrier based fighter to land aboard a carrier. This was accomplished in July 1946 on the U.S.S. FDR.

The Phantom had only one hydraulic circuit, the conventional master cylinder which powered the hydraulic brake system. This early jet was in the 500 mph class and was one of the last fighters to be armed with .50 cal machine guns.

Two models of the Banshee, F2H-1 in 1947 and the F2H-2 in 1949, followed. Certain modifications, including the addition of wing-tip tanks, gave the F2H-2 a greatly increased combat range over the F2H-1. Hydraulic services were extended and a high pressure pneumatic circuit was introduced. The hydraulic circuit included two independent 1670 psi open center systems, the constant displacement pumps being driven by electric motors. These operated the aileron boost system, a poppet type metering valve directing fluid to the power cylinder.

A 1500 psi compressor, electric motor driven, provided power for the gun chargers. The compressor also provided canopy emergency power through an air motor, emergency nose gear extension, arresting gear retraction and wheel brake boost. The F2H-1 was flight tested in June 1947 and the F2H-2 in August 1949. A first production order was placed in the latter month and

SPECIFY ADEL FOR THE BEST IN ANTI-ICING EQUIPMENT

ADEL anti-icing equipment is designed, engineered and precision-built for maximum performance and dependability. Today, ADEL equipment is on the latest aircraft because ADEL has the proven ability to better serve the industry.

Fluid Metering Pump Series "M" with capacities from 5 to 15 GPH at 20 psi, 27½ V.D.C. Width 3 1/16", length 6⅞". Weight 2.75 lbs. Single and dual outlet types. Meets all anti-icing requirements.

Filter-Micronic Series 12755 filters out foreign particles as small as 5 microns out of standard anti-icing and fuel heater system fluids. Aluminum bowl, easy to clean. Largest filter area available for size and weight (0.3 lb.).

Low-Pressure Check or Relief Valve Series 8182 widely used in fuel heater and anti-icing systems. Easily adjustable. Cracking pressure range from 4 psi to 130 psi. Capacities to 36 GPH at 40 psi.

Low-Pressure Shut-off Valve Series 12257, solenoid operated, for instant flow control at remote points in anti-icing and related systems. Ratings: 15, 40, 200 psi. 6, 12, 24, and 110V. D.C. Available with AN-type connectors.

ADEL also produces a complete line of HYDRAULIC & PNEUMATIC CONTROL EQUIPMENT, HEATER & FUEL SYSTEM EQUIPMENT, ENGINE ACCESSORIES and LINE SUPPORTS.

Write for new, descriptive Brochure containing detailed information on ADEL's line of Aircraft Anti-Icing, Heater and Fuel System Equipment. Address: ADEL DIVISION, GENERAL METALS CORPORATION, 10759 Van Owen Street, Burbank, Calif.

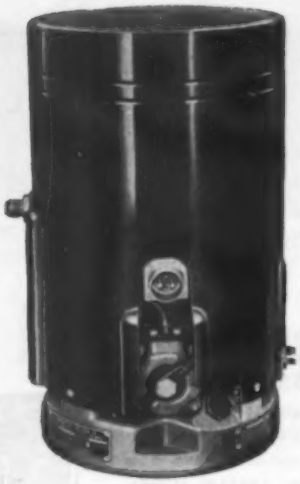
ADEL LEADER IN AIRCRAFT EQUIPMENT

DIVISION OF GENERAL METALS CORPORATION • BURBANK, CALIF. • HUNTINGTON, W. VA.

CANADIAN REPRESENTATIVE: RAILWAY & POWER ENGINEERING CORPORATION, LIMITED

NEWMATICS

SELF-CONTAINED RHODES LEWIS
HIGH-PRESSURE (3000 psi) COMPRESSOR
SAVES SPACE, WEIGHT, MAINTENANCE



features: Integral package unit, requires only simple power source and reservoir connections . . . operates 500 hours continuous duty per Specification MIL-C-7135 . . . used extensively in military aircraft pneumatic systems . . . easy to install and service . . . takes less than five minutes to install or remove entire package unit. *Approved by U. S. Navy for installation in military aircraft.*

See Rhodes Lewis for these new light-weight products and systems

ITEM	Used in high-pressure pneumatic systems	Used in low-pressure pneumatic systems	Other aircraft applications
AC & DC Compressors	X	X	
Hydraulically Driven Compressors	X	X	
Bleed Turbine Compressors	X	X	
Fiberglass Pneumatic Receivers	X	X	
Electrical & Electronic Control Systems			X
AC & DC Motors	X	X	X
Small Accessory Turbine Drives	X	X	X
Pneumatic Valves, Operated Electrically or Mechanically	X	X	
Solenoids, Intermittent or Continuous Duty	X	X	X
Pneumatic Ejection Systems	X	X	

Take advantage of Rhodes Lewis engineering knowledge and manufacturing facilities in the field of electrical and pneumatic equipment. Your inquiries are cordially invited.

RHODES LEWIS CO.
Subsidiary of McCulloch Motors Corporation
6151 W. 98th Street,
Los Angeles 45, California

McCULLOCH

ELECTRIC PNEUMATIC ENGINEERS · MANUFACTURERS

the final F2H-2 was delivered late in April 1952. Both models of the Banshee were powered by two Westinghouse J-34 turbo-jets and were in the 600 mph class and over 1500 mile combat range.

In 1947 the same manufacturer built the XF 88-A Voodoo, a land based type for USAF. Afterburners were added to the same power plants, wings were swept back at a 35 degree angle and the services included an automatic yaw dampener. This plane did not reach the production stage.

The hydraulic system had two engine driven variable displacement pumps in the 1500 psi closed center system. Services included operation of the landing gear, canopy, flap, speed brake actuation, brakes, nose wheel steering, elevator, aileron and rudder power controls.

A 1500 psi compressor, motor driven, provided power for the gun chargers, as well as for the emergency canopy release. Figure 2 shows this airplane in flight.

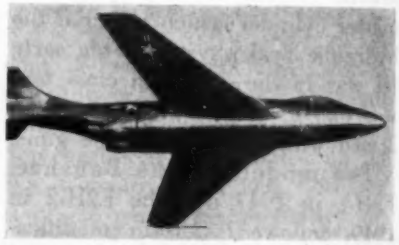


FIG. 2. While the Voodoo (XF-88-A) never reached the production stage, its hydraulic system provided for more than six services and the high pressure air system operated gun chargers and the canopy emergency release.

The third Banshee for the Navy, the F2H-3, an all weather fighter, was contracted for in 1950 and deliveries began in 1952. A 1500 psi closed center hydraulic system contains two engine driven variable displacement pumps. The hydraulic services include the operation of irreversible aileron and elevator power controls and wing folding. The pneumatic circuit has a larger compressor than the F2H-2; the increased services include: power for gun chargers, gun gas ventilation doors, arresting gear retraction, nose gear extension, wheel brake boost and emergency canopy operation.

British Engineering Exposition

ONE of the most important exhibitions in the British calendar is the Engineering and Marine and Welding Exhibition which has been held every alternate year in London (except during war-time), for nearly fifty years.

Last September in the nineteenth of this series of Exhibitions, there were over 500 exhibits covering more than a quarter of a million square feet.

All the principal manufacturers of industrial hydraulic and pneumatic equipment were represented.

The Towler Brothers exhibited the all-hydraulic push button system for control of large presses. This innovation, known as "Autodraulic," provides an easily operated manual or automatic cycle without recourse to solenoids, micro-switches or any other electrical gadgets. One of the main advantages claimed for this type of control is simplicity of maintenance compared to complex electrical circuits.

An unusual application of hydraulics has been developed in the Berger "Handraulic" starter for internal combustion engines. This mechanism consists of a hydro-pneumatic accumulator, release valve, and the starter unit bolted to the front end of the crankshaft. This unit comprises two hydraulic pistons, on the rods of which are cut racks meshing with a pinion located coaxially with the starting claw on the crankshaft. On the application of pressure to the pistons the rods extend, one tangentially above the pinion and the other below it, so that the racks rotate the pinion and transmit the rotary motion to the crankshaft via the starting claw. The pistons are returned to their original positions by springs. The accumulator is initially charged with air to a pressure of 2,000 psi which is sealed in its cylinder. By means of hand pump the hydraulic fluid is then forced into the oil side of the accumulator to a pressure of 4,000 psi. This stored energy is sufficient to give three starts to smaller engines, and one start to those requiring a larger capacity starter.

Finney Presses Ltd. of Birmingham featured hydraulic power packs comprising tank, motor and two-stage pump complete with unloading and selector valves. A special feature of the Finney pump is the unusual method of unloading. When the rated pressure has been built up a patented, automatic relay gear lifts the suction valves of the pump from their seats to prevent intake of further oil while the outlet valves remain closed retaining the rated pressure in the output pipe-lines. This method of unloading reduces the "idling" horse power consumption to a very low figure and prevents overheating of the oil. The Finney pump incorporates a low pressure high volume, double helical gear pump (also automatically unloaded) for fast approach, from which the high pressure piston pump takes over to provide the final squeeze.

The increased popularity of hydraulically powered pipe bending machines was evidenced by the number of these being offered, several of which are capable of accomplishing bends up to 180 degrees in 2 inch diameter pipes.

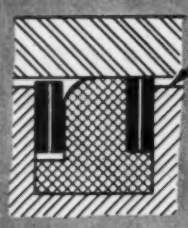
PALMETTO® G-T® RING

The Packing TAYLOR-WILSON Picked for

"PRESSURE-PLUS"

In Taylor-Wilson's Automatic Hydraulic Pipe Testing Machine, the main packing problem was that of pressure. Non-extrusion at 3000 psi-water was the requirement. The G-T Ring was used successfully in a Youngstown Sheet & Tube Co. installation and in a pipe-tester later installed for the National Tube Co., a division of U. S. Steel Corporation. It has been "under pressure" for Taylor-Wilson ever since!

CANNOT EXTRUDE, *because*



As pressure is applied, conventional packings soon extrude into clearance space Y, then fail. Not so the G-T Ring! Because of its design consisting of a resilient sealing ring in a T-Section supported on each side by two non-extrusion rings, it cannot extrude. As pressure is applied to the G-T Ring, the resilient material flows under the non-extrusion rings, urging them against the cylinder wall and blocking the path of extrusion.

In pressure applications, dynamic or static—pick Palmetto G-T Ring—the packing **designed expressly for** non-extrusion.

OUR 90th YEAR — NEARLY A CENTURY OF *Quality*

Write for literature on Palmetto Molded Packings for more information on G-T Ring and other specialized molded packings.

PALMETTO Packings

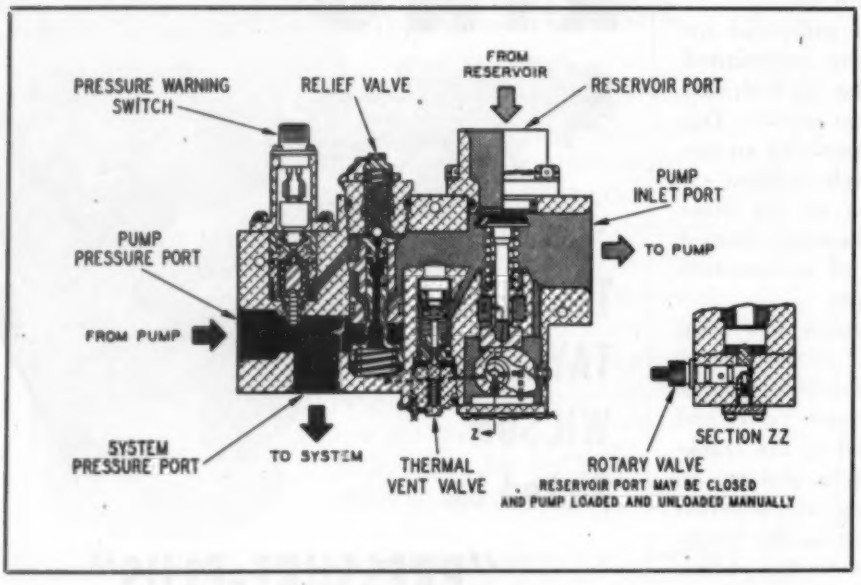
packing more performance into every application

GREENE, TWEED & CO. North Wales, Pa.

Circle 42 on Reader Service Card

ONE VALVE REPLACES SIX

A new pump control valve used in the Super Constellation hydraulic system cuts down weight, cost and maintenance.



LATE model Super Constellations are equipped with four pump control valves—one per pump. Use of this accessory allows a reduction in the number of separate hydraulic units from 14 to 4 and eliminates four electrical switches.

Replacement of multiple accessories by the single valve has reduced procurement costs by about 66 percent. This does not include savings due to the simplified plumbing. The installation weight saving is significant.

PUMP CONTROL VALVE provides pressure control, thermal relief, on-off action and a pressure warning device.

Unexcelled In Performance And Quality ...The NEW FLUID CONTROLS 3/4" RELIEF VALVES

- DEPENDABLE
- HIGH CAPACITY
- EFFICIENT
- CONSTANT PRESSURE

A quality valve for the most exacting applications. Write today for detailed data and prices.

- For Oil • Relief Pressure—Adjustable 50 to 3000 P. S. I. • Total over-all size 2" x 2" x 5¼"

Fluid Controls, inc.

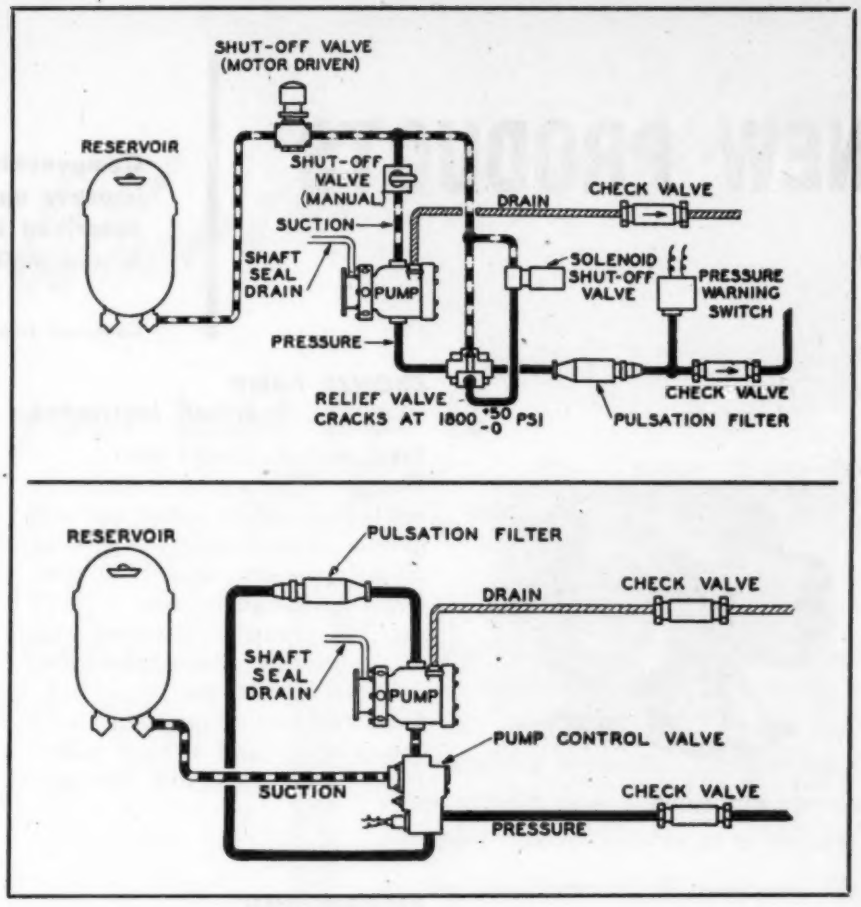
Manufacturers of Hydraulic Valves and Devices

Relief Valves • Check Valves • Restrictor Valves • Needle Valves • Pilot Check Valves • Clamping Valves • Small Spring Loaded Accumulators • Special Valves

1284 N. CENTER STREET MENTOR, OHIO

TOP CIRCUIT shows the Constellation hydraulic system before the use of the pump control valve. BOTTOM CIRCUIT shows the simplification resulting from the use of this combination valve.

Courtesy Vickers, Inc.



On the new Constellation this valve permits unlimited operation of the hydraulic pumps in the shut-off position without damage. Thus individual pump performance can be checked with all engines running without the possibility of damaging the other three when shut-off. The suction hose will not collapse when the pump is shut off. If some system malfunction causes excessive fluid temperature rise, the thermal feature will automatically cut out the pump involved.

The valve design includes manual unloading of the pump. Maximum system pressure is limited by a built-in relief valve. A pressure actuated electric switch is provided for use in a signal system to indicate system pressure changes. The pump shut-off manual control also serves as a firewall shut-off device.

cut pump-down time in half!

increase operating efficiency!

of....

Vacuum pumps

with the new

Houdaille DRI-PURE (WATER-OIL SEPARATOR)

● **Removes moisture from vacuum pump oils; cuts pump-down time in half**

Keeps oil clean and dry. Enables pump to provide a high vacuum *without oil change* and eliminates pump "drying out" maintenance!

● **Eliminates changing or discarding of oil; allows maximum pump operating efficiency**

Increases production due to less downtime. Actually provides *2-way protection*—filtering out contaminants as it separates water!

DRI-PURE is easy to install—can be hooked up to service one or more vacuum pumps depending on the application. *Quickly pays for itself in oil savings alone!*

WRITE TODAY for complete information. Equipment Bulletin available on request.

WORLD'S LEADING OIL FILTER MANUFACTURER

Honan-Crane Corp. 102 Wabash Avenue, Lebanon, Indiana

a subsidiary of... **Houdaille-Hershey Corp.**

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NEW PRODUCTS

Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.

Continued from page 18

BRONZE PUMP
. . . is self lubricated

Designation: Model 4300
Design: The pump impeller is self-lubricated by water and will deliver approximately 7 gpm at 50 psi pressure and 1750 rpm. Pressure range is from 0 to 75 psi. The pump is furnished with ¾ in. ports. Recommended speeds to 1800 rpm.
Construction: Equipped with scoop rotor and rubber roller-type vanes, designed for production in bronze to meet continuous water recirculation requirements. It has sealed, permanently lubricated ball bearings. An additional feature is a pressed fit of the stainless steel shaft into the inner ball bearing race to restrict lateral movement of the rotor, minimizing end thrust wear within the pump.

Hypro Engineering, Inc.
404 No. Washington Ave.
Minneapolis 1, Minn.

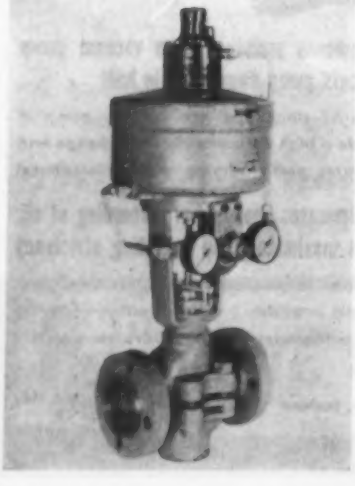
Circle 229 on Reader Service Card

PISTON PUMP
. . . high pressure small volume

Designation: "P" series hydraulic power pumps
Design: Three, five or ten cylinder radial pumps can be supplied with variable-size plungers and liners to vary the volumetric output between 40 cu ins and 3½ gallons per minute. Maximum intermittent working pressure is 1750 psi and ceiling pressure (relief valve) is 2500 psi. Speed range is 1,000 to 5,000 rpm.
Applications: Two independent services may be operated from any pump by special grouping of the cylinders, a characteristic of interest to manufacturers of fork-lift trucks, where power to tilt the mast is required in addition to lifting power.

Smiths Jacking Systems Ltd.
London, England

Circle 230 on Reader Service Card



CONTROL VALVE
. . . features single seat

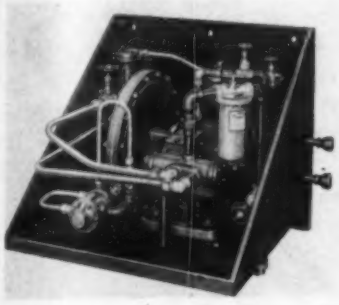
Designation: LB Series
Design: A new concept of valve topworks is coupled with a completely new single-seated, split body valve design. Useful for many exacting requirements of the process industries for the accurate, sensitive and positive control of many hard to handle fluids. The topwork consists essentially of an aluminum cylinder with carefully bored and honed internals, a plastic piston with graphite impregnated "O" ring seal and a unique integral positioning device that permits the static or cushion loading pressure to be in either the upper or lower cylinder chamber.
Sizes: Up to and including 4 in.
Construction: Valve bodies are available as standard in carbon steel, bronze, aluminum, 316 stainless steel, Hastelloy and Durimet. Trim materials include alloys, hardened stainless steel, hard faced metals and non-metallic seating surface. Angle type bodies are available as well as straight through designs.

Conoflow Corporation
2100 Arch Street
Philadelphia 3, Pa.

Circle 231 on Reader Service Card

NON-RETURN VALVE OPERATOR
. . . converts valve system

Design: The regulator operates the non-return valve to maintain a constant low differential pressure across the valve. A reversal of pressure causes the valve to



close. The operator has a high output and will control large tight-closing valves. Because of low permanent pressure loss through the valve, there is a better utilization of compressor power. Counterweights, springs and dashpots are not necessary. The operator permits use of a simple internal design valve, free from pockets that can accumulate dirt and tar.

Application: Designed to make a hydraulically operated non-return or check valve, of a simple butterfly valve.

Askania Regulator Company
240 East Ontario Street
Chicago 11, Illinois
Circle 232 on Reader Service Card

AIRCRAFT MOTOR
. . . has output speed of 5000 rpm

Designation: Type GA

Design: This self-ventilated ½ hp aircraft motor with integral gearing is rated for continuous duty up to 35,000 ft. altitude. Output speeds are available from 1500 to 5000 rpm and is designed to operate on 3-phase, 400 cycle alternating current.

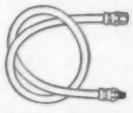
Features: Thermal overload protection is one of the features of this unit. Others include, integral cooling fan, hardened and shaved helical gears, internal spline take-off shafts, AN mounting pad, rapid acceleration and high torque.

U. S. Electrical Motors, Inc.
Aircraft Division
Los Angeles 54, California
Circle 233 on Reader Service Card

your best bet is

FLEX-O-TUBE®

Supplied in Assemblies



Flex-O-Tube will help you determine the assembly needed or work to your own specifications. In either case, modern facilities and latest inspection techniques assure you a uniformly high quality product delivered promptly.

Supplied for Field Assembly

Flex-O-Tube hose is also supplied in bulk coils with reusable fittings for field assembly. Complete range of sizes and types.

If you use flexible hose in your product or for replacement in your plant, it will pay you to specify Flex-O-Tube. For here is a name that has stood for finest quality and dependable service for more than a quarter of a century.

In the development of new uses for flexible hose, Flex-O-Tube provides you with dependable experience in the field. When used for replacement in industrial maintenance, Flex-O-Tube provides you with a complete range of products that are easy to assemble and long on performance.

Whatever your needs, why not discuss them with the local Flex-O-Tube field engineer. You'll find there are many good reasons why industry has relied on Flex-O-Tube for miles and miles of flexible hose products.

Please send me your free ☐ aircraft catalog. ☐ industrial catalog.

Name .....

Company .....

City ..... Zone ..... State .....

Address .....

FLEX-O-TUBE
DIVISION OF MERIDAN CORP.
764 FOURTEENTH • DETROIT 16, MICHIGAN

Solve

straight-line motion problems

with O-M CYLINDERS (air • hydraulic)

elevating • lowering • pushing • pulling • tilting • clamping • opening • closing • knock-out operations

From a smooth, delicate push on a testing machine to a rugged thrust on a press application, O-M Cylinders handle all straight-line motion problems with ease and precision. *Special interlocking mechanism* eliminates needless tie rods, end caps . . . saves 1/3 INSTALLATION SPACE. Also assures better alignment, gives O-M the lowest coefficient of friction of *any* cylinder . . . smoother performance at low or high pressure regardless of length of stroke. End plugs tapped for universal mounting. Any one or combination of mounting brackets may be used to install . . . *without disassembling or changing cylinder.* Easily removed, inspected, repaired.

Available in a full range of sizes (1½" to 8" bores) with standard, 2 to 1 or oversize rods. All machined steel with bearing bronze, no castings. Completely interchangeable parts.

14-day delivery on most sizes

Send today for FREE catalog and complete set of ½ and ¼-scale templates showing all cylinders and mounting brackets.

MAIL COUPON NOW!

ORTMAN MILLER MACHINE CO.

1204 150th Street • Hammond, Indiana

☐ Please send latest O-M catalog.

☐ Please send complete set of templates.

Name.....

Company.....

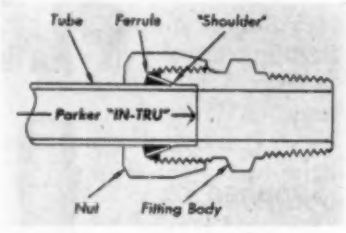
Address.....

City.....Zone...State....

FLARELESS TUBE FITTINGS . . . for instrumentation

Sizes: Tube O.D.'s from ½ through 1 in.

Operation: After the tube is seated, the nut is tightened. Tightening of the nut exerts a wedging force on the ferrule. The ferrule, in turn, "bites" into the outer surface of the tube



forming a "shoulder". This shoulder insures a leakproof connection. Because the cutting edge of the ferrule is exposed, the extent of bite into the tube is readily visible if the joint is disconnected for inspection. After inspection, the fitting is reassembled by hand until the ferrule is seated. An additional 1/6 to 1/3 turn of the nut completes the assembly.

Features: Flareless, brass and aluminum; do not require soldering or welding of the joints. There is no flaring of the tube and no need for any special tools. Complete assembly of a joint is made with a wrench to tighten the fitting nut. Fittings use "In-Tru" ferrule to accommodate flareless tube.

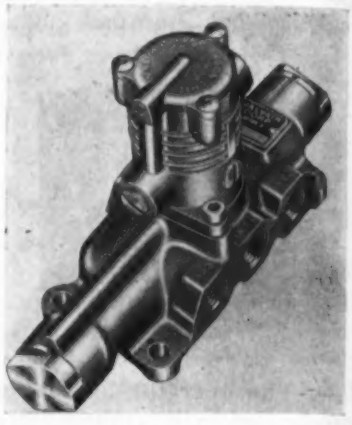
The Parker Appliance Company, Cleveland, Ohio

Circle 234 on Reader Service Card

SOLENOID PILOT-OPERATED VALVES . . . for air circuits

Sizes: Available for 3-way, 4-way and 4-way 5 port (two pressure) application in pipe sizes ¼" through 1 in. The ⅜ in 4-way foot mounted valve is only 7¾ long by 4¾ high and 2¾ in wide.

Design: All types and sizes are furnished either for foot mounting or sub-base manifold mounting in accordance with J.I.C. specifications. A total of 30 new valves is included in this line. Minimum life expectancy of upwards of 20,000,000 cycles can be conservatively anticipated. Parts are non-corrosive. The main valve body, and also the sub-base, is cast bronze. The spool is stainless steel, hard chrome plated and polished to assure long life to the special Hycar "O" ring seals. There is



REDUCE Z GAP PROTECT O RINGS THE REID WAY

← Teflon BACK-UP RINGS

This Not This

REID pioneer in chemically-inert Teflon, introduces 30° scarfing to reduce Z-gap and prevent marking or distortion of O-Ring. • Newly designed to fit BOTH piston groove diameter and rod diameter. • Many times more accurate than leather. Much lower coefficient of friction. • Non-corrosive, long-wearing, self-lubricating. • Withstands -100° F. to 500° F. • MANDREL-packed to maintain dimensional accuracy, prevent tangling. • 4 types: spiral, spiral even-cut, split, solid. • Write today.

REID Enterprises

Kimball 9243 3715 Santa Fe Avenue Los Angeles 58, Calif.

no spring in the main valve, since air from the pilot valve is utilized to reverse the spool in both directions. The spool is the one moving part of the main valve body, and all parts are easily accessible without disturbing the piping to the valve. The pilot valve control unit is manifolded with cap screws to the main valve body. The solenoid coil is replaceable and is available in any alternating current voltage and cycle, including all direct current requirements. The maximum current consumption at any voltage is only 10 watts, assuring cool operation and long life at operating speeds as high as 600 cycles per minute.

Application: All models are for air pressure from 35 to 150 psi and for low pressure oil hydraulic.

Valvair Corporation
Akron, Ohio

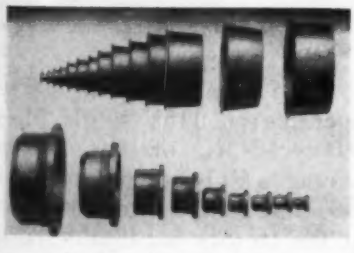
Circle 235 on Reader Service Card

PLASTIC CLOSURES
. . . for thread protection

Designation: CaPlug

Sizes: Standard non-threaded closures are available in sizes to fit any diameter from ⅛ to 1½ in. and are obtainable in special sizes up to 3½ in. Stocked sizes of the new threaded plugs range from 5/16-24 thread to 2½-12 thread.

Design: They are molded of tough, flexible polyethylene plas-



tic and are impervious to all common chemical reagents, such as solvents, sterilizing agents, caustic and acid baths, and will not chip, break or shred under severe conditions.

Features: Non-threaded closures, looking like red thimbles in smaller sizes and bottle or jar caps in larger sizes, push on easily over pipe or tubing ends as caps or insert readily in round openings as plugs. Ideal as dust

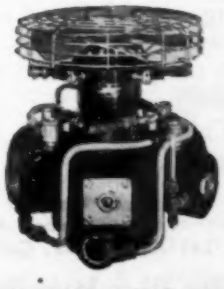
REPUBLIC AVIATION JOINS Cornelius FAMILY

CORNELIUS COMPRESSOR STANDARD EQUIPMENT ON F-84F THUNDERSTREAK

Republic's F-84F THUNDERSTREAK is the latest and fastest flying member of a rugged family which has long served the U.S. Air Forces' needs in the fighter and fighter-bomber field.

● In equipping the F-84F THUNDERSTREAK with the CORNELIUS AIR COMPRESSOR Republic Aviation joins the CORNELIUS family of famous names in aviation . . . Boeing, Canadair, Chance Vought, Douglas, Lockheed, Martin, McDonnell, North American, Northrop.

CORNELIUS is proud of this recognition . . . developed from long experience building dependable pneumatic equipment for the Air Force, Navy and leading aircraft manufacturers. Profit from our experience . . . write to us about your pneumatic equipment requirements.



CORNELIUS COMPRESSOR
4CFM . . . 3000 PSI
Powered by integral hydraulic motor. Other models available with various pumping capacities. All compressors can be furnished with either hydraulic motors, DC electric motors or AC 400 cycle motors.

THE Cornelius COMPANY
MINNEAPOLIS 21, MINNESOTA

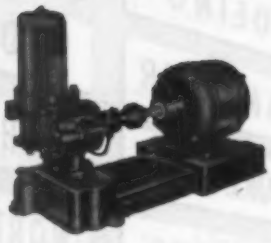
Pioneers in the Development of
AIRCRAFT PNEUMATIC SYSTEMS

KRAISSL

• Since 1926 • in the application, design and manufacture —pumps, separators, hydraulic accessories.

EQUIPMENT FOR FLUID POWER TRANSMISSION

Primary Oil Pumps • Vacuum Powered Transmission and Low Pressure Air Service • Air and Liquid Filters •



Rotary Air Pumps for vacuum bottling

Kraissl's patented, automatic, force-feed lubrication and flushing system makes these direct-drive, high-capacity pumps ideal for the special requirements of bottle-filling machinery.

Air-cooled design—or water-cooled models for heavier duty.

Class 21 roller-action pumps are recommended for handling corrosive gases and extraneous matter that might jam with closer clearances. The multi-blade design of the Class 25 pumps gives higher capacity efficiencies and is designed for applications requiring higher degree of vacuum.

Where water-cooling is desired for continuous service, the water-jacketed Class 25-WJ models are recommended.

Our exclusive Class 26 design air filter can be furnished as an integral part of each pump, up to 10 cfm—to produce oil-free discharge air and also conserve the lubricating oil.

Write today for Bulletin A-1289, for air-cooled pumps—and for A-1523 for the water-cooled models.

KRAISSL CO

305 Williams Ave., Hackensack

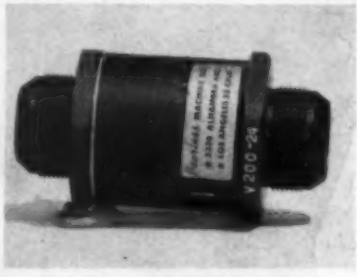
and moisture seals and shipping protectors for delicate fittings, they are also used as dipping process inserts and for masking of threads and parts during paint spraying. Threaded plugs are available from the same material. They are threaded at the top for ease of application.

Protective Closures Co.
CaPlugs Division
2207 Elmwood Ave.
Buffalo 22, New York

Circle 236 on Reader Service Card

ALL METAL VALVE
. . . for extreme pressures

Designation: Free-Flo
Sizes: The valve is available in sizes from ¼ to 5 in. with ports to all AN standards, both threaded and flanged with straight or



elbow bodies, or designed to the customer's specifications.
Design: The valve is of the swing type and has an extremely low pressure drop. The material is aluminum alloy and stainless steel or all stainless steel as required. Designed for aircraft and guided missiles, it is also suitable for industrial use.
Application: Suitable for all types of fuel, air or oil. It is also being used for liquid oxygen and for water and alcohol. It is in use with temperatures as low as –300 F and up to 1000 F, in missiles and also with white fuming nitric acid.

Peerless Machine Co.
5338 Alhambra Ave.
Los Angeles 32, California

Circle 237 on Reader Service Card

DEHUMIDIFIER
. . . for compressed air circuit

Designation: Vi-Speed dehumidifier
Features: Self-cleaning device that purifies compressed air and reduces humidity to a very low dew point. Improvements include self-adjusting nozzle coupled with nonclogging aspirator. This automatic control stabilizes unit operation during variable air pressures, and volumes for constant removal of injurious liquids, solids and vaporous contaminants. Baffle surfaces have been enlarged and re-positioned for greater exposure of contaminants to action of "Dryolite" potent drying agent.

Van Products Co.,
Erie, Pa.

Circle 238 on Reader Service Card

BENDING MACHINE
. . . for hydraulic tubing

Designation: No. 60 Power Portable 1¼ in.
Operation: A drill press ¾ hp motor actuates the bending by pulling the trigger switch. The toggle switch above the trigger switch controls the forward or reverse rotation of the bend.
Features: Hand carried from place to place; bend from ½ to

1¼ in IPS pipe to 180 degrees; operates on 115V-single phase-60 cycle AC or DC current; averages 60 bends per hour with one man; limit switches, preset at the factory for 0 and 180 degree rotation of bending prevent the possibility of overtravel in either forward or reverse direction; designed to operate so that the machine can be placed anywhere along a length of pipe and then operated at that location; all steel, arc welded construction for maximum strength and minimum weight.

Wallace Supplies Mfg. Company
Chicago, Ill.

Circle 239 on Reader Service Card

Circle 46 on Reader Service Card

Here's The New Gre-Sen Hydraulic

DIFFERENTIAL RELIEF VALVE

Another Gre-Sen Quality Product at Mass Production Prices.

Features

- ★ Hardened Steel Plunger and Seat
- ★ Smooth Operating Pressure Regulating Screw
- ★ Light Spring Has Long Life and Low Stress
- ★ Grey Cast Iron Body

Series D.R. Relief Valves are available in three pressure ranges.

Model D.R.—75-A—Pressure Range— 100 to 500 P.S.I.
Model D.R.—75-B—Pressure Range— 500 to 1250 P.S.I.
Model D.R.—75-C—Pressure Range—1250 to 2500 P.S.I.

Write for Literature

GRE-SEN MANUFACTURING CO.

628 Colfax Ave. N. Dept. H-113 Minneapolis 11, Minn.

"SEAL-GUARD" METALLIC ROD WIPER

PROTECTS YOUR CYLINDER RODS, MACHINE SPINDLES, GUIDE PINS AND LOCATING PINS

The "Seal-Guard" Metallic Rod Wiper affords permanent protection from falling or flying debris . . . Two flexible bronze rings mounted in synthetic rubber lift off harmful substances completely by means of their knife-edged conical surfaces . . . The device is self-adjusting through action of rubber on staggered scraper rings . . . Rod diameter sizes are from ½ to 10 inches.

Write for Literature

HYDRAULIC ACCESSORIES CO.

24301 HOOVER RD. • VAN DYKE, MICHIGAN

Economical Bronze Design

Series I—Heavy duty bronze rotary gear pumps
Oilless bearings 2-23 G.P.M.—0-100 P.S.I. $14.25-$29.75 (six pumps)

Series II—Close coupled motor driven bronze pumps
Oilless bearings 2-4 G.P.M.—0-100 P.S.I. $20.00-$22.50 (two pumps)

Series F—High volume bronze rotary gear pumps
Oilless bearings 50-150 G.P.M.—0-150 P.S.I. $77.50-$200.00 (five pumps)

Series IV—Rubber impeller bronze pumps
Oilless bearings 6-21 G.P.M.—0-30 P.S.I. $16.00-$28.00 (three pumps)

Series 55—Standard bronze rotary gear pumps
Grease fittings 2-23 G.P.M.—0-100 P.S.I. $11.25-$29.00 (twelve pumps)

Series G—Standard bronze centrifugal pumps
Grease fittings 2-25 G.P.M.—2-10 P.S.I. $9.25-$24.00 (three pumps)

See our catalog in Sweet's PRODUCT DESIGN File

OBERDORFER BRONZE PUMPS

Industrial Pump Div., Oberdorfer Foundries, Inc.
5311 Thompson Rd., Syracuse, N. Y.

Address the 1953 edition of the Oberdorfer Industrial Pump catalog to:

NAME _____

COMPANY _____

ADDRESS _____

Do you want a factory representative to call ☐ Yes ☐ No

Circle 55 on Reader Service Card

Circle 78 on Reader Service Card

Hydraulics Put More Dig In a Digger!

The famous FOUR BOLT Design HYDRECO Hydraulic Pump as installed in photo at left.

Deluxe Pippin Excavator, built by Cone Automatic Machine Co., Inc., Windsor, Vt., and distributed by PIPPIN CONSTRUCTION EQUIPMENT, INC., White River Junction, Vt., digs to 10' depth; lift 12'; reach 16'; swing 12½'. Digs 10-foot trench without moving tractor.

The HYDRECO Hollow Plunger Control Valve.

Yes, the PIPPIN Digger is Oil Powered by HYDRECO HYDRAULIC EQUIPMENT

The new Pippin Digger does the work of many strong backs without a drop of perspiration... and it's HYDRECO Oil Power that supplies the muscle and wrist action! The operator simply flips his controls and digs a precise trench, pit or excavation. Whether the surface is level, rough or sloping he can control his work at all times.

The famous Hydreco Four-Bolt Pump delivers the power... seven Hydreco Cylinders provide the linear motion for each function... the Hydreco Selector Valve enables the operator to stabilize the digger and operate the dipper stick with a *single* hydraulic circuit. Throttling is accurate, there are no momentary load drops and the dipper stick goes when and where the operator wants it!

The HYDRECO Cylinder controlling the dipper.

Design your circuits around HYDRECO! Pumps 3 to 130 gpm.... Motors to 52 hp.... Hollow Plunger Control Valves 5 to 80 gpm.... a complete line of single-acting, double-acting and telescoping Cylinders for operating pressure to 1500 psi. Write today for full information on HYDRECO Oil Power.

HYDRECO DIVISION
THE NEW YORK AIR BRAKE COMPANY
1104 EAST 222nd STREET • CLEVELAND 17 • OHIO

New Products

PRESSURE TRANSMITTER ... withstands extreme vibration

Designation: Model 45176 Pressure Transducer

Design: Available in ranges from 0-10 to 0-30 psi in 5 psi increments, in special pressure ranges, and can be had with various resistances and with cases that will withstand pressures of

1500 psi. A low loss filter is furnished in the input pressure port, and models are available with temperature compensation. The unit will operate when subjected to environmental vibration of 5G in the frequency range from 10-500 cps and can be made to withstand shocks of 40G without structural damage.

Features: Use of stable insulating materials, (such as lava, glass, etc.) noble metal alloy resistance wire and brush, plus a new type of brush design, insures accuracy over long periods of use. Up to 50 volts output can be obtained where an electrical signal proportional to pressure is required. High sensitivity and accuracy are obtained by using a frictionless spring flexure pivot movement design, which requires no gears or bearings to obtain movement amplification.

G. M. Giannini & Co.
Pasadena, California

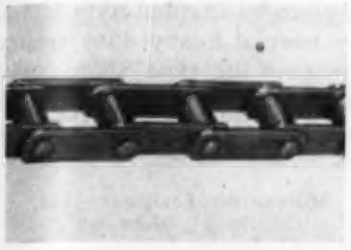
Circle 239 on Reader Service Card

IMPROVED SPROCKET CHAINS ... have controlled heat-treatment

Designation: R, RX, and RR

Design: An improved line of drive and conveyor sprocket

chains includes controlled material selection and heat-treatment for the ultimate in wear resist-

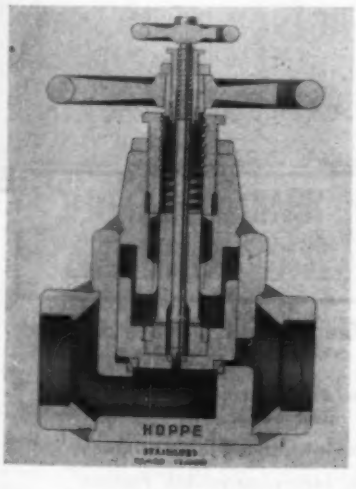


ance and strength, closer planned tolerances of press fits for longer life and smooth operation, better finishes, easier to assemble and to disassemble. This new series of chains will operate on standard sprockets. These chains replace and supplement a group of the most standard and popular sizes. The R and RX series are drive chains and the RR series are conveyor chains.

Chain Belt Company
Milwaukee 1, Wisconsin
Circle 240 on Reader Service Card

DUAL CONTROL VALVE . . . has welded construction

Size: 3 to 10 in.
Design: Ball bearing stem, all stellite disc and seats and the elimination of packing bolts.
Features: High temperature, inside valve and all internal parts



are polished to reduce corrosion, hydrostatic test pressure of 60,000 psi, dual control valve opens with pressure and closes with pressure, piston guided and full opening through port.

Hoppe Engineering Company, Inc.
Greensboro, Indiana
Circle 241 on Reader Service Card

the ALL Way Balanced Dual-Vane

DUDCO
HYDRAULIC PUMP

Featuring starting torques higher than running torques, DUDCO has long been recognized as the most efficient Fluid Motor in the field. Standard models from 180 lb. in. to 14,400 lb. in.

One look at the inside of a DUDCO Pump tells the story of efficiency through *fully* balanced construction. Note how, at all times, the Dual-Vanes provide a *double* barrier to slippage and lost power. These DUDCO Vanes are individually balanced to closely follow the cam ring contour without wear-producing thrust . . . their unique displacement action provides an extra 15% to 20% added volume.

Smooth, non-pulsating DUDCO power, delivering 2000 psi for continuous operation, frequently doubles the capacity of less efficient hydraulic circuits. Standard models from 3 gpm to 120 gpm.

DUDCO DIVISION
THE NEW YORK AIR BRAKE COMPANY
1704 EAST NINE MILE ROAD • HAZEL PARK • MICH.

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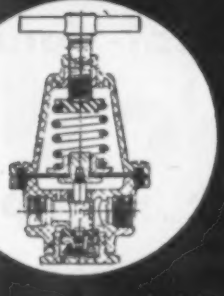
acro

by AIR CONVERSION RESEARCH

a high quality low maintenance cost pressure regulator



it's light!
it's strong!
it's made of A.C.R.'s new miracle alloy . . .
VOLIDIUM!

Available in both Non-Bleeding and Self-Bleeding models

acro regulators lead the field in capacity and accurate regulation. **acro** prevents secondary pressure losses yet allows instant response to demand changes, and regulates accurately over the entire pressure range. **acro**'s give complete flexibility to solve your air control problems. WRITE, WIRE OR PHONE NOW FOR MORE INFORMATION.

there is an **acro** *regulator for every purpose, every pressure!*

AIR CONVERSION RESEARCH
CORPORATION
4107 N. Damen Ave. Chicago 18, Ill.

Gentlemen: Please send me full information about **acro** regulators. Dept. AH
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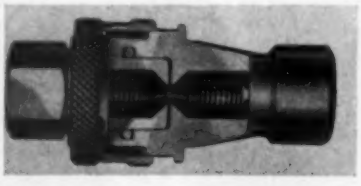
New Products

Continued

SHUT-OFF COUPLING
. . . is quick connecting

Designation: Series HK
Sizes: ⅛ to 1 in.
Features: Hydraulic and pneumatic lines can be quickly and easily connected or disconnected



—with both ends of the line sealed when the coupling is disconnected. A torpedo valve in the socket instantly contacts the valve seat—thus providing immediate and positive seal against the escape of gas or liquid from the socket end of the line, when the coupling is disconnected. An identical action seats the torpedo type valve in the plug end of the coupling to provide similar seal of the gas or liquid in the plug end of the line. When the coupling is connected, fluid flows freely through the coupling, with seal against leakage insured by the compression of an "O" ring in the socket body against the outside surface of the inserted plug.
Applications: Where quick connective couplings for smaller size pneumatic and hydraulic lines are required.

The Hansen Manufacturing Company
Cleveland, Ohio

Circle 242 on Reader Service Card

PENDANT HOISTS
. . . lift up to 5 tons

Design: A pneumatic hoist which can be used for most load lifting capacities and for raising the load through any height, the determining factors being the diameter of the bore and the length of piston stroke. Hoists are produced which cover any load up to 5 tons, the illustrated hoist lifts 1 ton. The pendant hoists require more headroom than the horizontal types. They can be supplied only with trollies up to 25 cwt capacity, though they can be adapted to fit almost any normal heavy duty trolley. The pendant type shares with the horizontal series, the advantages of variable speed control and balance effect.

Marton Air Equipment, Ltd.
Parkshot, Richmond
Surrey, England

Circle 243 on Reader Service Card

MANIFOLD MOUNT VALVES
. . . Eliminates pipe, saves space

Designation: Manifold Mount Valves
Sizes: ⅛, ¼, ⅜ and ½ inch NPT for any of the 2-, 3- and 4-way valves now in their line.
Features: Compact design: illustration shows a 4-way, ¼ in. NPT valve with pilot actuation and spring return; valve dimensions 6-1/16 in. long, 1-⅝ in. long and 2 in. wide. Mounting requires only drilling holes in

HAND HYDRAULIC PUMP

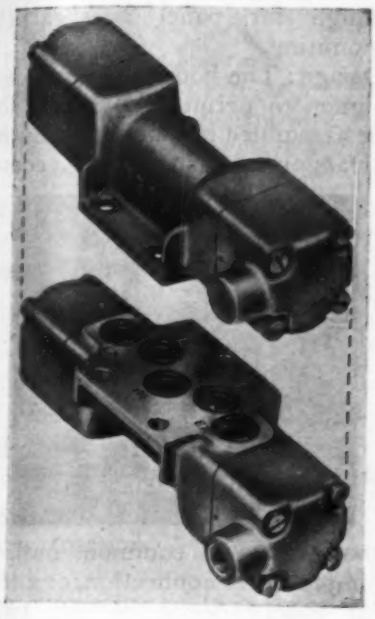
Single and Double Designs To 20,000 P. S. I.

- **Dual Pump Unit Reservoir. 360 cu. in.**
- **Interchangeable Pistons**
- **Interchangeable Pistons ⅜-½-¾ inch**

Pressure range is 3,000 to 20,000 P.S.I. Pipe connections ¼" N.P.T. Handle length is 18 inches. Weight is 8 to 18 pounds. Unit can be bolted or welded into position. "We specialize in hand pump units to operate in temperatures from minus 65 F to plus 160 F and with any capacity reservoirs required."

WILLIAM S. PINE
1637 E. 22nd St., Los Angeles 11, Calif.

manifold to match port holes and bolting in place. All internal parts are interchangeable, valves can be serviced or disassembled without disturbing pipe connec-

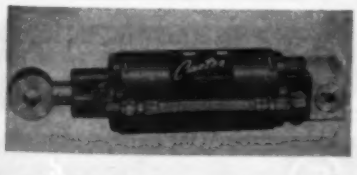


tions. An exclusive "anti-extrusion" arrangement of kinetic "O" ring seals insures air tightness after long service.

Versa Products Co., Incorporated
Brooklyn, N. Y.
Circle 244 on Reader Service Card

AIR CYLINDER
. . . with integral pilot valve

Size: Furnished in cylinder diameters of 1½ through 6 in.
Features: The integral valve is of universal type furnished so



that it can be operated by miniature poppets, direct or remote, or converted to single or double solenoid operation. Valve can be furnished with dual speed controls. A full line of two-way poppet valves for air-limit, hand or foot operation will be offered in addition to standard electrical conversion units. Air cylinder features a built-in operating valve.

Carter Controls
2972 Bernice Road
Lansing, Illinois
Circle 245 on Reader Service Card

Braided through and through for longer service, less maintenance!

GARLOCK LATTICE BRAID* PACKINGS

APPLICATIONS
On rotating shafts, reciprocating rods or rams, expansion joints and valve stems

TYPES OF SERVICES
Water, oil, solvents, acids, steam, gases, etc., at temperatures up to 700° F.

AVAILABLE MATERIALS
Asbestos (Canadian or Blue African)
Asbestos—wire reinforced
Flax
Cotton
"Teflon" or asbestos with "Teflon" impregnation

AVAILABLE FORMS
Ring, coil, or reel

Every strand of LATTICE BRAID packing passes diagonally through the body of the packing to form a completely unified structure—braided internally as well as externally. This patented LATTICE BRAID method has these advantages:

1. Prevents the packings from disintegrating when subjected to wear.
2. Makes the packings flexible so they can be formed into rings without distortion.
3. Allows us to control porosity so that the right amount of liquid is absorbed for lubrication.
4. Imparts a semi-automatic action to the packings. This eliminates the need for frequent gland adjustments.

For complete information send for LATTICE BRAID Folder AD-131. Write the nearest Garlock branch or to our main office.

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GARLOCK

PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS,
RUBBER EXPANSION JOINTS

Specify

DONNELL

hydraulic systems and components

- mobile equipment
- stationary units
- portable applications

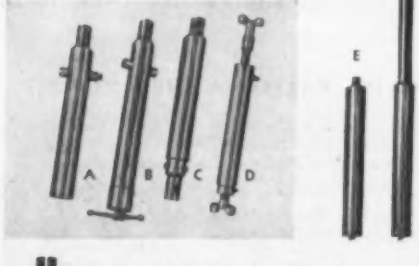
hydro-pac power package
hydro-pac pumps
handy-lift hand pumps
hydro-pac valves

100 to 5000 psi
150 in.³/min. at 1000 psi
6 volt - 12 volt - 28 volt dc - 110 volt ac

Donnell simplified design and exclusive patented advantages assure you of greater dependability and longer maintenance-free operation of hydraulic components.

MORE THAN 500 TYPES OF HYDRAULIC RAMS

- **A** Trunion mounted ram with oil inlet in one trunion boss.
- **B** Trunion mounted ram with control valves in base.
- **C** Standard single acting ram.
- **D** Push-pull ram with special yokes on base and plunger.
- **E** Telescopic rams are streamlined.



Write for Engineering data and specifications.

DONNELL
Hydraulic Company
Marengo • Illinois

New Products

Continued

ROTATING SWIVEL
. . . for high pressures

Designation: Model 4000

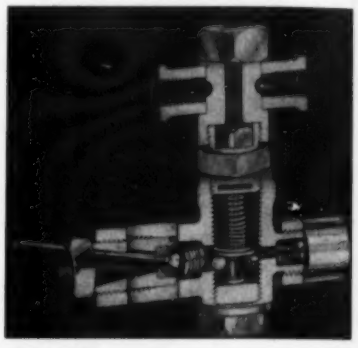
Design: Designed for high pressure and high operating speeds, spring loaded Teflon ring and self centering ball thrust bearings.
Application: Present applications in brake and clutch field.

Hydraulic Unit Specialties Co.
304 N. Grand Ave.
Waukesha, Wisconsin

Circle 246 on Reader Service Card

AIR VALVE
. . . permits flexibility

Designation: Wobble-Rod
Sizes: Right and left hand outlets (¼ in ips); a double-ended inlet (¼ in ips) which can be rotated and clamped through a full 360 degrees. A drilled and tapped flange for panel or bracket mounting.
Design: The body casting is designed to permit two valves to be assembled into one unit. Such arrangements can provide a com-



mon inlet, a common outlet, simple series connection, or a total independence of the two valves. Thus, three-way, four-way, tandem or synchronized operations can be served.
Construction: Constructed en-

A Shock-absorbing bumpers cushion stroke, assure longer service life.

B Silicon steel laminations give high efficiency.

C Tempered steel spring absorbs vibration — holds assembly firmly in alignment.

D Hardened beryllium-copper plunger guide reduces friction and wear.

E Heavy Formvar insulated magnet wire on high flow point molded nylon bobbin.

Decco INDUSTRIAL SOLENOIDS

Built better for longer service.
Shock mounted to reduce self-destruction.
Designed to meet J. I. C. specifications.
Four to twenty pounds—push or pull.
Stroke to one inch maximum.
A. C. or D. C. models.

Special solenoid problems engineered to your needs.

DETROIT COIL COMPANY
2435 HILTON ROAD • DETROIT 20, (FERNDALE) MICHIGAN

tirely of non-corrosive metals, the valve requires no maintenance and has exceptionally long life. Bronze, brass and stainless steel are used throughout. There are no rubber or fiber seats or diaphragms.

Features: The lever which opens and closes the valve is a hardened rod so swiveled that the free end can move vertically, laterally, diagonally or in arcs and circles. The valve can be actuated manually, mechanically or electrically.

Pantex Manufacturing Company
521 Roosevelt Ave.
Pawtucket, R.I.

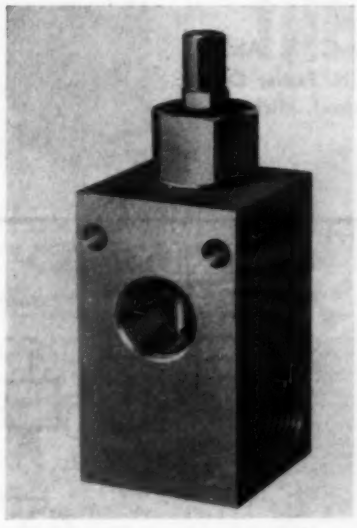
Circle 247 on Reader Service Card

RELIEF VALVES
. . . for constant pressures

Size: ¾ in.

Construction: These valves are of the pilot type, where a small or pilot valve controls the action of a large main valve. This construction results in a relief valve with the constant pressure characteristics required for exacting applications. The construction also eliminates the need for large springs. Relief pressure is adjustable from 50 to 300 psi.

Application: Designed for oil or



gasoline and are particularly well adapted for farm machinery, road machinery and material handling equipment.

Fluid Controls
1284 N. Center Street
Mentor, Ohio

Circle 248 on Reader Service Card

UCON
TRADE-MARK

hydrolubes . . .

and **NON-FLAMMABILITY**

Ucon hydrolubes are hydraulic fluids that contain water for non-flammability. They are balanced formulations of water, an anti-freeze, and a water-soluble synthetic lubricant. They contain carefully selected corrosion inhibitors, metal deactivators, and anti-wear agents. As long as the water concentration is maintained, Ucon hydrolubes are non-flammable.

For safety, economy, and efficiency—switch to Ucon hydrolubes. They can be used with conventional packings and seals—without revamping.

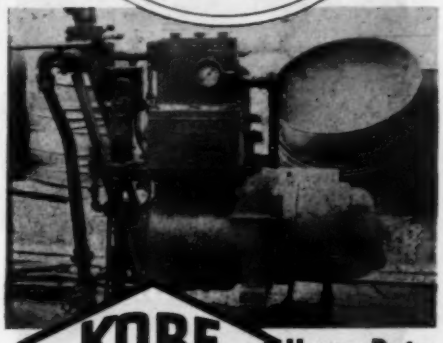
Write today for the booklet, "UCON Hydrolubes," F-7380.

Carbide and Carbon Chemicals Company
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.

"Ucon" is a registered trade-mark of Union Carbide and Carbon Corporation

STAMP OF APPROVAL

SUPERIOR TANK AND CONSTRUCTION CO. TRIPLE SEAL TANKS



KOBE Heavy Duty High Pressure

Triplex Pumps

Case History A-15: In 1944, a Kobe Size 3 Triplex was installed at the Superior Tank and Construction Company, Los Angeles, California, manufacturers of oil production tanks and pressure vessels for the transportation industry. The Kobe operates a 500 ton hydraulic press, used to die-cut segments of spheres for Butane and Propane tanks. Pressure required is 2000 psi.

". . . wonderful service"

Satisfaction with the Kobe Triplex is indicated by this statement from Grover C. Brown, company sales manager: "We like the Triplex. It has been in almost constant operation and hasn't given us a bit of trouble. There has never been a major repair or overhaul on the unit, and we think it's fine. The Kobe has given us *wonderful service.* We recommend it heartily."

Triplex Features

- **Pressures—To 5,000 psi (standard) To 20,000 psi (special)**
- **Volumes—To 60 g.p.m.**
- **Power Ratings—15, 30, 50 H.P.**
- **Integral Double Reduction Gears**
- **Integral Electric Drive (Optional)**
- **Easily interchanged Plungers and Liners**

Write for Bulletin

KOBE INC., Division of Dresser Equipment Co., 615 NBC Bldg., 815 Superior Ave., N.E. Cleveland 14, Ohio

KOBE INC.
Division of Dresser Equipment Co.
Plant: Huntington Park, Calif. — Representatives in CLEVELAND, Pittsburgh, New York, Houston, Oklahoma City.

AIR CYLINDERS

PISTON PACKINGS "REPLACE" THEMSELVES

Compressed air expands Neoprene Rings, keeps Graphited Asbestos Packings under constant pressure. Packings automatically compensate for gradual wear . . . practically eliminates repacking downtime.

Precision-made in a wide range of models, 2" to 12" bore. Representatives in principal cities. Prompt deliveries. Send for copy of S-P Catalog No. 102.

S-P HYDRAULIC CYLINDERS

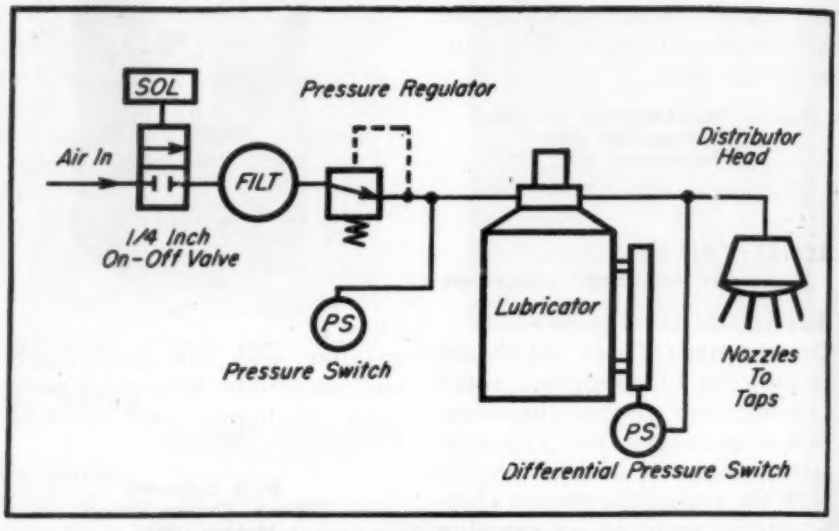
11 models in 11 sizes
Packing cartridge • J.I.C. Standards
2000 p.s.i. *Every modern design feature*
Send for Catalog No. 103.

OTHER S-P PRODUCTS: Power Chucks, Rotating Air Cylinders, Parallel Grip Collet Chucks, Drill Press Chucks, Expanding Arbors, Blank Jaws, Air Valves, Air Pistons, Air Control Accessories.

THE S-P MFG. CORP.
ESTABLISHED 1910
1245 EUCLID AVENUE
CLEVELAND 6, OHIO
A Bassett Company

AIR CIRCUIT for Machine Tool Lubrication

By C. S. Abbott
J. N. Fauver Co. Inc.
Detroit, Michigan



MOVEMENT OF A TAPPING HEAD trips a limit switch to energize the solenoid of the on-off valve. The valve opens to admit air to the lubricator.

ONE of the design requirements on transfer type machine tools is to provide a reliable lubrication system. Because machine breakdowns on high production machines are extremely expensive, the lubrication system becomes even more important than usual. Shown in the drawing is the pressure switch protected air circuit designed to spray oil on the taps used in Cross Transfermatics.

Limit Switch Opens Valve

The ¼ inch on-off solenoid valve is opened by the tripping of a limit switch when the taps move into position. Air then passes through the valve, through a filter, regulator, 2 gallon lubricator, distributor head, and out nozzles from this distributor head to the taps. Construction of the distributor is such that regardless of the number of outlets, an equal distribution of oiled air leaves the head to the various taps and it is possible to lubricate from 2 to 16 taps by changing the design of the distributor head.

There are two important safety features. A low pressure switch is connected to the down stream side of the air pressure regulator. If for any reason air does not pass through the regulator, a low pressure will result and the pressure switch will shut off the machine. Also a differential pressure switch is used to record oil level in the lubricator. If the level falls to a low position, approximately 2 inches from the bottom of the lubricator, the switch which is very sensitive will close and also shut off the machine. These two pressure switches provide a safety arrangement which would shut off the machine if either there is no air or no oil.

If the taps are not oiled before each operation, tap breakage would be excessive and resultant down time would make the entire transfer machine impractical. The design of this air circuit insures oiling before each operation.

Circle 58 on Reader Service Card

Now Save 36% On Installation Time

with IMPERIAL *Hi-Duty* TUBE FITTINGS

Just push tube into fitting without removing nut and tighten . . . that's all.

Repeated, thorough tests reveal that IMPERIAL HI-DUTY FITTINGS can be assembled in 36% less time than regular COMPRESSION TYPE FITTINGS . . . and in 71% less time than FLARE TYPE FITTINGS. These are spectacular savings.

Fitting is furnished with integrated nut and sleeve assembled. To get a tight joint, simply insert tube into fitting and tighten nut. No loose sleeve to drop.

MAKES FAR STRONGER JOINTS because sleeve is always in perfect alignment and because its design minimizes deformation of tubing. Hi-Duty Fittings remain leakproof even under severe service; withstand over 5 times as much vibration as ordinary compression or flared fittings.

Furnished in Brass, Aluminum, Steel and Stainless Steel For Tubing ⅛" to ¾" O.D.

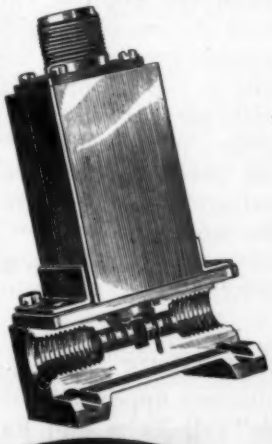
See Your Supply House

Ask for Bulletin No. 3002

THE IMPERIAL BRASS MFG. CO., 1242 W. Harrison St., Chicago 7, Ill.
In Canada: 334 Lauder Ave., Toronto, Ontario

IMPERIAL — **Pioneers in Tube Fitting and Tube Working Tools**

NEW *VALCOR* PRINCIPLE IS SOLVING MORE SOLENOID VALVE PROBLEMS



*Valcor Floating Shear Seal: Simple design eliminates need for precision fits. Seals 100% in both directions . . . and seal improves with use because of self-lapping. Self-cleaning, cannot clog because of exclusive floating shear seal action.

• **Straight-Through Flow:** Absolute minimum pressure drop.

• **Sealed-in-Coil:** Never an electrical failure reported. Built to withstand shock, vibration, and the elements.

Send for free booklet— "The Valcor Solenoid Valve with the Floating Shear Seal."

Valcor Engineering Corp.
Carnegie Ave.,
Kenilworth, N. J.

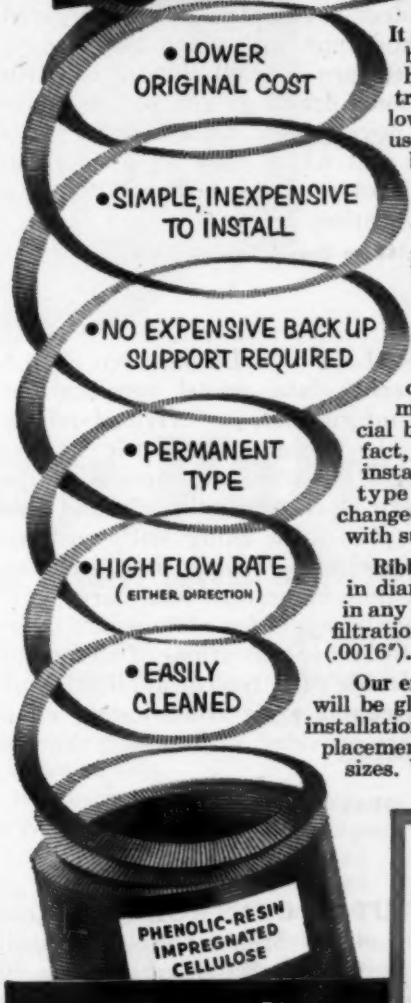
VALCOR
Solenoid Valves

*Pat. Pending

Circle 119 on Reader Service Card

The SIMPLER THE FILTER THE LOWER THE COST

Specify **Bendix-Skinner RIBBON FILTER ELEMENTS . . .**


• LOWER ORIGINAL COST
• SIMPLE, INEXPENSIVE TO INSTALL
• NO EXPENSIVE BACK UP SUPPORT REQUIRED
• PERMANENT TYPE
• HIGH FLOW RATE (EITHER DIRECTION)
• EASILY CLEANED
PHENOLIC-RESIN IMPREGNATED CELLULOSE

It seems hard to believe, but you can actually have more efficient filtration at considerably lower cost if you simply use Bendix-Skinner ribbon elements instead of expensive and less adaptable metal edge or metal screen types.

Here's how it works— Bendix-Skinner ribbon elements are inexpensive to begin with and can be installed at far less cost than metallic elements that require special back-up supports. In fact, in practically every instance present metallic-type elements can be changed over to ribbon-type with substantial savings.

Ribbon units are available in diameters from ½" to 6" in any required length with filtration rated at 40 microns (.0016").

Our engineering department will be glad to advise on new installations or to furnish replacement units in a variety of sizes. Write us for details.

Bendix-Skinner

ORIGINATOR OF **MICRONIC** FILTRATION

SKINNER PURIFIERS DIVISION OF *Bendix*
1503 TROMBLY AVENUE, DETROIT 11, MICHIGAN

Export Sales: Bendix International Division, 205 East 42nd Street, New York 17, N. Y.

Circle 100 on Reader Service Card

USEFUL LITERATURE

You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation

Continued from page 10

OIL AND GREASE SEALS . . . An attractive presentation has been made on oil, grease and mechanical seals, by The Garlock Packing Company. Catalog 10 consists of 100 pages in color with information complete in every detail. Subjects covered in this booklet are engineering data, installation instructions, resistance to fluids chart, typical applications, trouble tips, sizes and part numbers. Also a numerical list by part numbers of seals is included. A complete review is given of each model and type seal which they manufacture. The literature is well illustrated with many cross-sectional drawings and pictorial sectional views. A novel visual index aids in locating the type of seal which may be of interest. The seals are listed first as an illustration and secondly by application.

Circle 182 on Reader Service Card

OVERLOAD RELAY . . . Bulletin No. 5101A covering engineering data, model specifications and application information on overload relays, has been released by Heinemann Electric Co. The bulletin includes a complete description of the hydraulic-magnetic operating principle and this is shown in graphic form along with outlined data on the hermetically sealed time element. Shown also is a time vs percent load curve, giving definite response points for various size overloads. Dimensions and specifications of all models are given and details of a typical application in protecting a three-phase air conditioning compressor motor, are provided to illustrate the circuit.

Circle 183 on Reader Service Card

ELECTRIC CLUTCH CONTROL . . . Micro Switch, a division of Minneapolis-Honeywell Regulator Company, has released catalog No. 59 describing their "Microtrip", a power machine safety control which provides a means of electrical control for any manually operated machine. A presentation is made regarding the application on a power press. Each type of control equipment is outlined, including auxiliaries and switches and the methods by which it is possible to control the machine. It is explained that power clutch-actuating equipment is necessary on machines which provide only for direct manual engagement of the clutch. A complete presentation is made including additional equipment which may be necessary, such as solenoid and air cylinder clutch actuators, valves etc, which are illustrated and rated.

Circle 184 on Reader Service Card

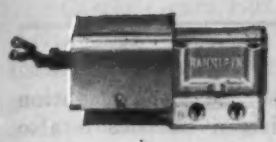
DC MOTORS AND GENERATORS . . . Bulletin No. 1450 has been released by The Louis Allis Co. This bulletin presents a line of dc motors from ½ to 300 hp and dc generators from ¾ to 250 kw. The literature is well illustrated, showing the various types of pumps made for different applications. There is an interesting section on dc electrical characteristics of the shunt motor, the series motor and the compound motor. Another section of the bulletin is devoted to dc adjustable speed application data. Many special dc motors and generators are illustrated for special applications. Included also are motor generator sets.

Circle 185 on Reader Service Card

FLOW RATE MEASUREMENT . . . Of liquids and gases by the variable-area method are described in catalog No. 10-A-10, prepared by Fischer & Porter Company. The catalog discusses meters and presents objective comparisons between the popular variable-area types and the more common variable-head meters. How the variable-area meter works, it's basic flow equation, as well as information on calibration scales, metering range, permanent pressure loss, upstream piping effects, viscosity effects, purging and pulsating flow are also discussed. Many illustrations and graphs add to the usefulness of the catalog.

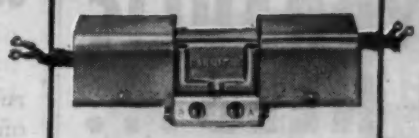
Circle 186 on Reader Service Card

SILICONES . . . A very unusual presentation of silicones appears in the "new frontier edition" of "Tall Tales and Fabulous Facts", a 24 page booklet released by Dow Corning Corporation. Much reference literature is offered in this booklet and is available by writing for those in which there is interest. Information can be obtained on silicone release agents, silicone lubricants, silicone dielectrics, silicone water repellants, silicone



CC1-25, Solenoid-Operated
Spring Return

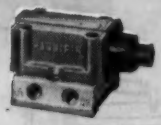
CC6-25, Foot Operated



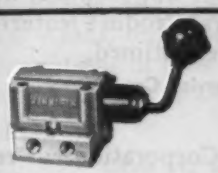
CC11-25, Solenoid-Operated
Momentary Contact Type

CC7-25, Foot-Operated Locking

CC2-25, Ball Cam-Operated

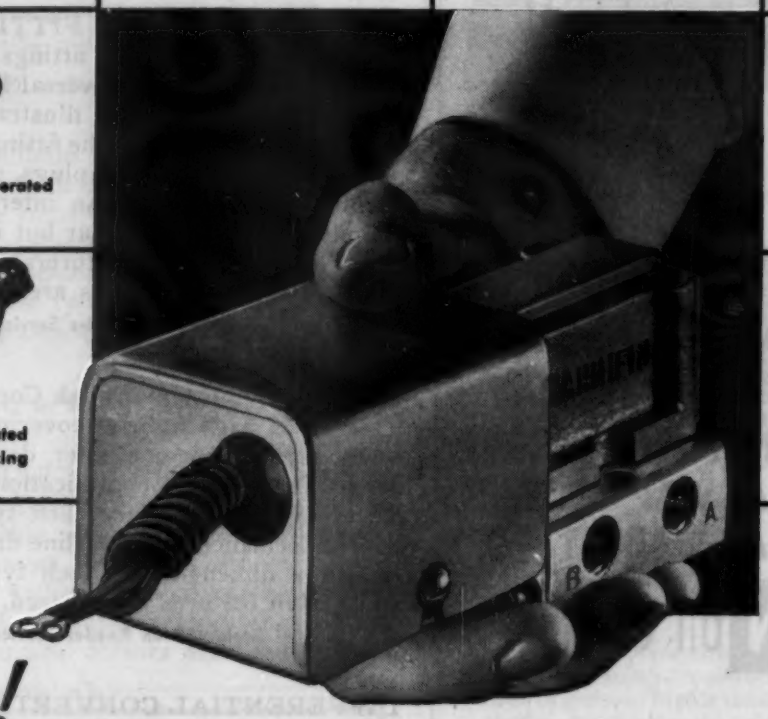


CC10-25, Piston-Operated
Spring Return



CC4-25, Hand-Operated
CC5-25, (Same), Locking

CC12-25, Piston-Operated
Momentary Contact Type



Now!

¼" P-M 4-Way Valves!

more compact, less expensive than any similar valves

Here's a new series of direct-operated 4-Way Valves for the control of small, double-acting air cylinders. It's the latest addition to Hannifin's revolutionary "P-M" line.

Designed for easier maintenance. The only moving part is the valve stem with its two poppets. The valve body, which contains this stem, is quickly removed from the separate "manifold" to which all pipe connections are made. Thus, the entire valve can be serviced without breaking line connections.

The CC Series. These new "P-M" 4-Way Valves, nominally of ¼" pipe size, flow so much air that they can be used competitively with other ⅜" valves when ordered with ⅜" ports. They are corrosion resistant throughout and meet J.I.C. recommendations.

Compare! You'll find these new Hannifin 4-Way Valves more compact, simpler and easier to use, and *less expensive* than any comparable valves.

GET THE COMPLETE HANNIFIN "P-M" AIR CONTROL VALVE CATALOG

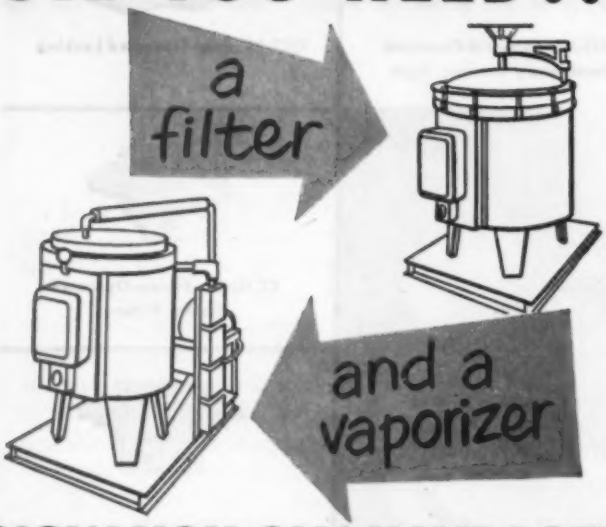
The new Hannifin Controls Catalog contains complete information and specifications on all Hannifin "P-M" Valves, including this new 4-Way direct-operated series. Write for Bulletin 232.

HANNIFIN

Hannifin Corporation, 1155 S. Kilbourn Ave., Chicago 24, Ill.

Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

TO RECONDITION DIRTY HYDRAULIC OIL YOU NEED...



NOW YOU CAN HAVE BOTH A FILTER AND A VAPORIZER IN ONE COMPACT UNIT—

The HOFFMAN Oil Conditioner

The Hoffman Oil Conditioner restores contaminated hydraulic oil to a "like new" condition. The unit operates unattended, removing both soluble and insoluble material from dirty oil and recirculating clean oil to the hydraulic system.

The cartridge filter removes all insoluble sludge, acid and metallic particles. The oil vaporizer, operating with low temperature and low vacuum, drives off water and other soluble liquids.

The Hoffman Oil Conditioner assures clean hydraulic oil at all times with little maintenance. The unit operates with no moving parts except motor and pumps. No high speed bearings or parts to increase repair and replacement costs.

Models are available from 25 to 600 g.p.h. Portable Oil Conditioners are available where a more flexible operation is needed.

Write for detailed case studies or for Bulletin A-667.

Hoffman
INDUSTRIAL FILTRATION EQUIPMENT & SERVICE
U. S. HOFFMAN MACHINERY CORP., 239 LAMSON STREET, SYRACUSE 6, N. Y.
In Canada: Canadian Hoffman Machinery Co., Ltd., Newmarket, Ont.

Circle 118 on Reader Service Card

USEFUL LITERATURE

rubber and other silicone products. Information on air drying, weather resistant finishes is also included.

Circle 187 on Reader Service Card

HYDRAULIC GREASE FITTINGS . . . Many different styles of grease fittings are featured in a booklet released by Universal Lubricating Systems, Inc. Each style is illustrated and briefly described. In addition to the fittings, grease hoses, bushings, adapters, drain plugs, guns and swivel couplers are cataloged. An interchange chart is included which lists similar but not identical fittings for several manufacturers. Product features and packaging procedures are outlined.

Circle 188 on Reader Service Card

RELAYS . . . Joseph Pollak Corporation has released a 12 page bulletin covering the following types of relays, dc computer, dc miniature, ac or dc coaxial and dc communication. Complete specifications are given for each type. Installation and performance data and line drawings for each relay are dimensioned. Each type is illustrated and design features emphasized.

Circle 189 on Reader Service Card

DIFFERENTIAL CONVERTERS . . . Bulletin No. 2290, covers information on differential converter transmitters and is prepared by Minneapolis-Honeywell Regulator Co. Many features of the control are outlined. A pictorial cross-section view is used in explaining the operating principle. Parts are identified. Complete specifications are given. A few suggested installations are included. These converters operate on the highly sensitive pneumatic force-balance principle. They convert the differential pressure of flow into a proportionate air pressure and transmits that air pressure through tubing to indicating or recording receivers or controllers.

Circle 190 on Reader Service Card

AIR-WEIGHT CONTROL . . . Constant air-weight control for cupola blowers is described in bulletin No. 158, released by Askania Regulator Company. How it works, where it's used and many other questions are answered in this bulletin. It is explained that constant air-weight control is based on the principle that air-weight delivered by a motor-driven blower is directly proportional to the power consumed by the driving motor. The unit measures 3-phase power, puts out a high-level hydraulic signal in proportion to the deviation from a pre-set power level. The blast gate is positioned by this hydraulic force. A wiring diagram is included in the bulletin along with an illustration of the unit.

Circle 191 on Reader Service Card

HYDRAULIC VARIABLE SPEED GEARS . . . Carter Gears Ltd. are offering a Folder No. A/1, which describes the advantages and main features of hydraulic infinitely variable speed gears. The folder is complete with specifications and dimensions, horsepower and other ratings. Excellent photos show many types of motors and applications. An interesting section explains what variable speed gears are and how the unit works. This section is complete with a pictorial cross-section, graphs and other engineering data.

Circle 192 on Reader Service Card

SEALS . . . A bulletin is offered by Franklin C. Wolfe Co. Inc., which describes the various seal designs available from this company. A general description and application of their lock-o-seal, gask-o-seal, termin-o-seal and "O" ring is given. Illustrations of these types make the catalog more helpful in understanding how these seals can be applied.

Circle 193 on Reader Service Card

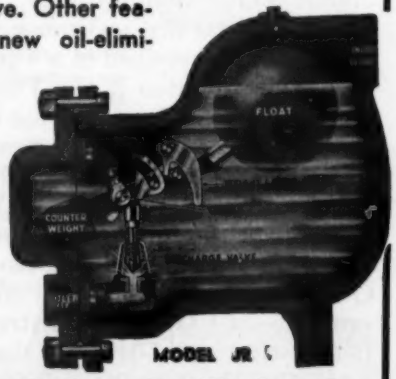
ROTATING SHAFT SEALS . . . Cartriseal Corporation is offering a bulletin on rotating shaft seals, suitable for all types of products. Cross-sectional views of various mountings are shown, together with a pictorial cut-a-way of a typical stator and of a typical rotor, which shows their various features. Rotors are "tailormade"

NICHOLSON AIR-GAS-STEAM TRAPS

NEVER NEED PRIME

Nicholson weight-operated traps, under no condition, leak pressure medium. This prevents the costly loss of air, gas or steam occurring when inverted bucket traps lose their prime. Nicholson traps hold tight because they have a positive water seal and do not depend on buoyancy of float to raise valve. Other features: exclusive new oil-eliminator; special hardened stainless steel valve. 3 types; pressures to 200, 500 and 1500 lbs. Send for...

CATALOG 953



213 Oregon St., Wilkes-Barre, Pa.

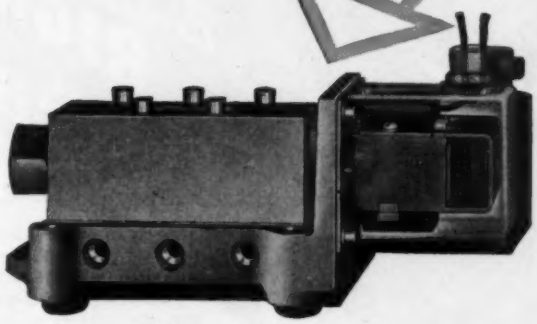
W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

Circle 77 on Reader Service Card

Quick-As-Wink AIR AND HYDRAULIC Control Valves

FEATURE THIS MONTH

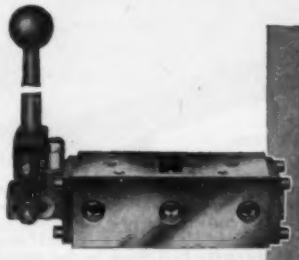


1/8" and 1/4" Single Solenoid Valves

They'll give you up to 300 cycles a minute
For air to 125 psi—vacuum—
or low pressure hydraulic service

● These valves combine the utmost simplicity in design with rugged construction. They will give you millions of cycles of highly satisfactory, efficient, trouble-free service. Small solenoid, with short stroke operates the valve plunger, eliminating levers, links and pins. Low amperage requirement eliminates intermediate relays and simplifies electrical control circuits. Side or bottom pipe connections. Valve body and solenoid are both mounted on an aluminum base and can be removed independently without disturbing the piping. 2, 3, 4 and 5-way actions. *Write for full details today!*

also the following

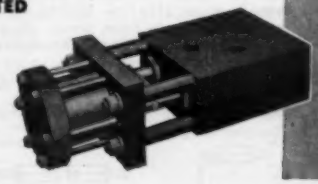


LEVER OPERATED SINGLE PLUNGER VALVES

Two position and three position valves, 3/8" to 1 1/2" sizes; 2-way, 3-way and 4-way actions. Widely used for controlling the operation of single and double acting cylinders or as pilots for operating other valves.

PILOT CYLINDER OPERATED HYDRAULIC VALVES

Two position valves, 1/2" to 4" sizes, for line pressures from 1000 to 5000 psi. Valve is placed close to the work and operated from a central control point with an easy to handle air valve avoiding operator fatigue.



For Fully Descriptive Data Sheets Write

C. B. HUNT & SON, Inc.

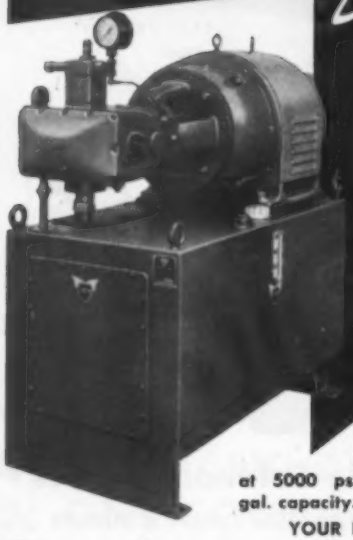
Hand, Foot, Lever, Cam, Pilot, Diaphragm and Solenoid Control Valves

1991 EAST PERSHING STREET • SALEM, OHIO

Circle 54 on Reader Service Card

Circle 17 on Reader Service Card

MORE POWER TO YOU
. . . from CENTURY!
CUSTOM HYDRAULIC POWER UNITS
Designed RIGHT!
Built RIGHT!
Priced RIGHT!



For example—This Century designed and built Power Unit. 50 H. P. motor drives variable delivery pump with maximum output of 20 gpm at 5000 psi. Century reservoir is 125 gal. capacity.

YOUR INQUIRIES ARE INVITED

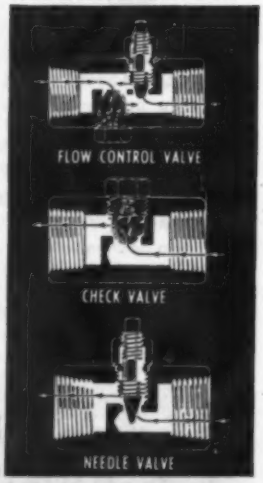
CENTURY HYDRAULICS, INC.
18135 JAMES COUZENS HIGHWAY • DETROIT 35, MICHIGAN

Get Easier, More Accurate Cylinder Speed Control with Pneu-Trol VALVES IN AIR OR HYDRAULIC USE

2000 and 5000 (steel) P.S.I.

Pneu-Trol Valves combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control and a floating retro ball check, which permits full flow in the opposite direction. Retro ball floats in most sensitive position to seat, requiring only a slight differential pressure to fully open or close it. Check Valve and Needle Valve incorporate single function features of Flow Control Valve. All valves available in 6 female pipe sizes — 1/8" to 3/4". Valve bodies are made from brass, aluminum, steel or stainless steel. Attractive Prices — Immediate Delivery.

Write for Illustrated Circular and Price List.



Pneu-Trol Devices, Inc.
1426 N. Keating Ave., Chicago 51, Ill.

USEFUL LITERATURE

to meet the specific needs of the user. Their design, operation, and use are explained completely.

Circle 194 on Reader Service Card

FLEXIBLE COUPLINGS . . . Lovejoy Flexible Coupling Company has released descriptive literature on the various types of flexible couplings which they manufacture. A specification and dimensional data sheet which gives the maximum bore, maximum hp at various rpm's, outside diameter, overall length, distance between shafts and other pertinent information, is included with each coupling type. Cross-sectional views show the construction of the various types and a selector chart is available to determine the correct coupling to be used. A section devoted to variable speed transmissions, gives specifications as to pulleys, bases, bolts and sheaves.

Circle 195 on Reader Service Card

"O" RINGS . . . The Parker Appliance Company has released a very complete 52 page catalog on "O" rings. This catalog is identified as No. 5100 and describes in detail the following types—"industrial" for general hydraulic, water or air service; "aircraft" for aircraft hydraulic service; "fitting gasket"; "fuel resistant", for gasoline and kerosene service; "oil-resistant"; "temperature resistant" and special service types. Each of the above types are illustrated with a cross-sectional view and many of the specifications such as temperature range, elongation and tensile strength are given. A complete listing of stock "O" rings with their nominal and actual sizes accompany each type. An interesting section in the back of the catalog deals with definitions of "O" ring terms, compound bases, requirements, gland design and installation requirements.

Circle 196 on Reader Service Card

NEW NONFLAMMABLE HYDRAULIC FLUID . . . A new nonflammable water base hydraulic fluid, "Houghto-Safe", developed to combine maximum fire resistance with top hydraulic efficiency, is described in a 4 page bulletin issued by E. F. Houghton & Co. The fluid is non-toxic, non-corrosive and safe for use in hydraulic equipment operated near open flames or adjacent to elevated temperatures. "Houghto-Safe" is a snuffer type fluid with high oxidation stability, a V.I. of 150 and the lubricating ability of high grade petroleum hydraulic fluids. It will pump easily at O F and has proven to be efficient at pumping pressures of 1000 psi. Film strength tests indicate that it will carry 2-½ times the load of petroleum hydraulic oil of similar viscosity. The fluid has been rated as "an acceptable hydraulic fluid from the fire hazard standpoint" by the Factory Mutual Engineering Division of Associated Mutual Fire Insurance Companies.

Circle 197 on Reader Service Card

DRAIN TRAPS . . . Literature, covering drain traps and cooling controls for compressed air, is offered by Sarco Company, Inc. Cross-sectional views of a drain trap, cooling controls and a diagram of an air separator equipped with float trap are included. Bulletin No. 520-DM covers this subject very thoroughly, describing in addition to the above, electric safety controls.

Circle 198 on Reader Service Card

AIR RELEASE AND AIR INLET VALVE . . . Bulletin No. 1203, is offered by Simplex Valve and Meter Company and describes the functions of the new combination air release and air inlet valve. A pictorial cross-sectional view of the valve in its open position and in its closed position, and a graph of discharge capacity, add to the complete description of its operation. Uses, weights and overall dimensions are also included.

Circle 199 on Reader Service Card

UNIT REGULATOR . . . An automatic control regulator of flow pressure, proportioning and other variables is described in an 8 page bulletin No. 155, released by Askania Regulator Company. The unit is a self-contained, hydraulic controller. The bulletin also presents the operating principles and the different models of the unit. It shows in addition, application diagrams and regulator specifications.

Circle 200 on Reader Service Card

LYNAIR

AIR and HYDRAULIC CYLINDERS

BEST FOR THAT TOUGH HEAVY-DUTY JOB

Whatever your air and hydraulic cylinder requirements may be, Lynair can supply your needs with the assurance of the utmost satisfaction . . . The complete Lynair line of standard cylinders represents quality material and workmanship unconditionally guaranteed . . . One marked advantage is the heavy-plated piston rods and the finest packing available, an assurance of maximum performance and enduring service . . . Also Lynair's engineering facilities are available for the design and manufacture of special application requirements. Prompt Delivery on all Standard Cylinders.

Write for Catalogs

LYNAIR, INC., Jackson, Michigan

Circle 72 on Reader Service Card

thread-protecting CaPlugs keep A-P valves clean and dry

Designed for dependable handling of freon and methyl chloride refrigerants, A-P Thermostatic Expansion Valves are completely dehydrated before shipment.

To hermetically seal these valves against moisture and dirt while in transit or in the warehouse — both inlet and outlet connections are capped with tough, flexible CaPlugs. Costly thread damage is also averted!

"Ease in installation, easy removal after use; appearance and price," are among the other important advantages to A-P Controls Corporation.

Impervious to all common chemical reagents, acids and solvents, multi-purpose CaPlugs (both threaded and plain) will not chip, break or shred under most severe conditions. Furnished for use as caps or plugs, to be applied inside or outside of threaded or plain fittings, they are promptly available in a wide range of sizes to meet a wide range of requirements.

Write for catalog, price lists and free CaPlug assortment.

CaPlugs

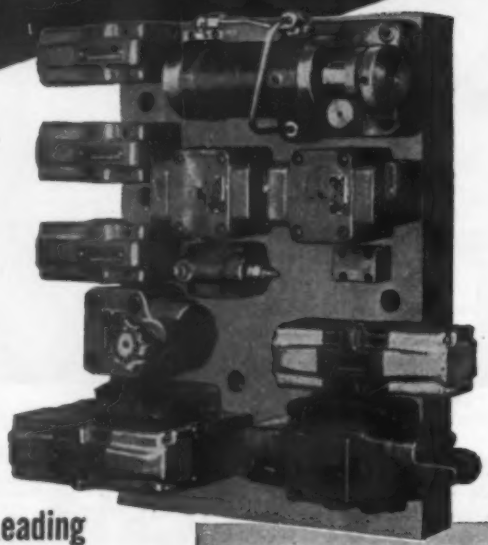
DIVISION

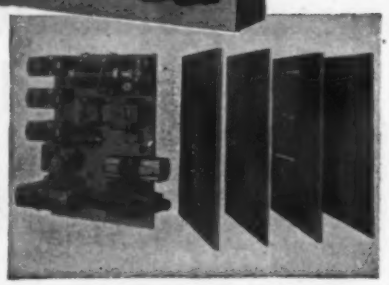
PROTECTIVE CLOSURES CO., INC.

2203 ELMWOOD AVE. BUFFALO 23, N. Y.

Circle 90 on Reader Service Card

ENGINEER *Simplicity* INTO YOUR HYDRAULIC EQUIPMENT CONTROL SYSTEMS





Leading Hydraulic Manufacturers Are Using Almo Manifolds to Cut Costs and Obtain Permanent Trouble-Free Operation

Almo has perfected the manifold method of channelling hydraulic fluids at high pressures after years of research and can apply it to your equipment. Send a diagram of one of your present hydraulic circuits. Without obligation we will return an Almo Manifold diagram demonstrating how the job can be completely simplified.

This maze of piping and tubing, all subject to failure resulting from vibration and deterioration, can be eliminated and made as compact and simple as the unit illustrated above.

Write for our new brochure

ALMO TOOL CO.

11470 KALTZ AVE. • CENTERLINE, MICH.

USEFUL LITERATURE

STEEL TUBING . . . A 12 page brochure, offered by Rochester Products, Division of General Motors, describes use, fabrication and physical properties of steel tubing for sizes from ⅛ to ⅝ in. Typical applications are illustrated, covering many products in which steel tubing can be used. Complete tables and data are provided, covering mechanical properties, diameters, tolerances, wall thicknesses and pressure tests for single and double wall tubing. The processing and fabrication of steel tubing for various uses is included. The following subjects are illustrated and described: forming finishes, cutting and machining and joints.

Circle 201 on Reader Service Card

FLEXIBLE METAL HOSE . . . A two color, 16 page product design catalog on flexible metal hose and instrument bellows, has just been released by Flexonics Corporation. Included in the bellows section are complete specifications, and detailed information on stainless steel, brass and bronze bellows, bellows assemblies and bellows devices. The hose section features complete specification and application data on convoluted and corrugated types of flexible metal hose, as well as details on flanges, couplings and other fittings. Included also are special purpose hose assemblies

Seal of Proven Performance

Modernair
AIR/FLUID POWER
Equipment Specialists

• Valves • Chucks • Cylinders • Silencers
• Solenoids • Hydraulic Pumps • Compressors
• Pilots • Air Controls • Machine Feeds
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Write for Catalog

Stocks in Principal Cities

Modernair CORPORATION

400 PREDA STREET • SAN LEANDRO, CALIFORNIA

Circle 7 on Reader Service Card

Circle 75 on Reader Service Card

and installation instructions. Many illustrations and specification data tables add to the usefulness of the literature.

Circle 202 on Reader Service Card

GENERAL PURPOSE PUMPS . . . Catalog No. 102, a 12 page piece of literature, prepared by Tuthill Pump Company, presents their line of rotary, internal-gear, positive displacement pumps for general use in handling non-corrosive liquids with lubricating qualities. Complete specifications of various model pumps, includes a cross-sectional drawing of each model. Each drawing is keyed so that dimensions are available in chart form. A table shows the part number of each component used in the pump. An interesting pump guide is prepared in chart form which can be used to determine the model best suited to certain individual needs, such as performance characteristics, mountings and pump features.

Circle 203 on Reader Service Card

To order your free copies of literature offered in these columns, use the convenient Reader Service Card. You'll find it bound between pages 114 and 115.

MOTOR STARTERS . . . Allis-Chalmers Manufacturing Company has released a 12 page bulletin No. 14B6410B, on motor starters, built to control squirrel-cage, synchronous wound rotor and multi-speed motors in ratings from 2200 to 5000 volts. Many models of starters are illustrated, including one with air break contactors and one with oil immersed contactors. Included also are schematic wiring diagrams which show typical methods of control. An interesting section of the bulletin describes how the air break contactor is made and how it works. Paragraphs on short-circuit and overload protection, time delay and pullout protection add to the value of the literature.

Circle 204 on Reader Service Card

TOGGLE SWITCHES . . . Micro, a division of Minneapolis-Honeywell Regulator Company has issued a new catalog #73 on toggle switches and toggle switch assemblies. Various types such as single pole, bushing mounted; single-pole, 3 hole mounting; toggle assembly with eight basic switches; other multiple-unit toggle assemblies; "subminiature" toggle switches and hermetically sealed precision switches are described. Each of the above sections are well illustrated and dimensioned for installation use. A chart is also provided for each type switch which gives characteristics and electrical ratings. A description of the switches is given along with construction features, such as contact arrangement.

Circle 205 on Reader Service Card

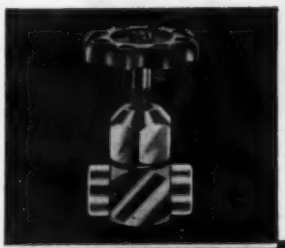
L and L

STEEL HYDRAULIC COUPLINGS

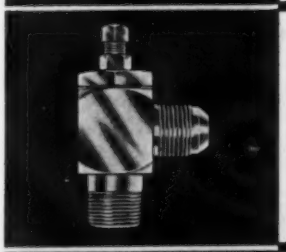
"THE MOST COMPLETE FITTING LINE"

JIC FLARED TUBE
DRYSEAL PIPE FITTINGS
RESTRICTORS
LATERALS
BARBED HOSE STEMS
HYDRAULIC ACCESSORIES

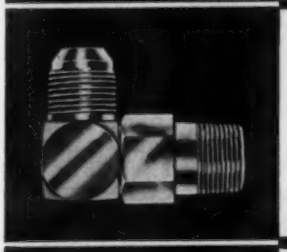
new products:



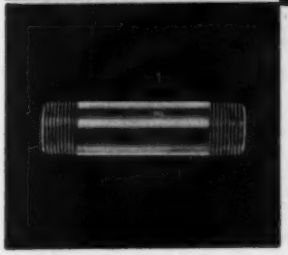
NEEDLE VALVES
- 5000 PSI
- Compact, bar stock body
- Use for shut-off or metering
- Tube or pipe outlets
- Line or angle



BALL CHECK VALVES
- Compact, bar stock body
- Tube or pipe outlets
- Fixed or adjustable spring loading



SWIVEL ELBOWS
- 1200 PSI
- Tube or pipe outlets
- Rotates 360°



PIPE NIPPLES
- Clean bore, seamless steel tubing
- Dryseal NPTF threads
- Cadmium plated

Representatives in principal cities
WRITE FOR CATALOG #53

L and L MANUFACTURING CO.
8088 E. NINE MILE RD.
VAN DYKE, MICH.

Circle 5 on Reader Service Card

AIR-MITE AIR ARBOR PRESSES

(AIR OR SPRING RETURN)

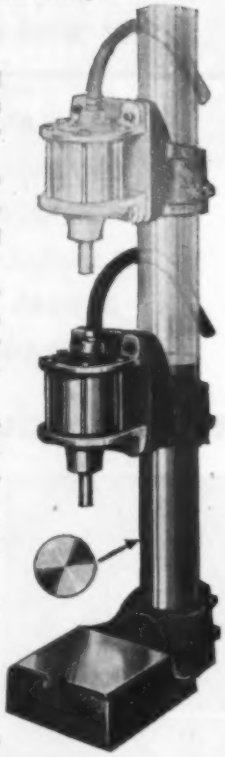
Completely Flexible

AIR-MITE now supplies solid steel upright columns in any lengths required to give you these important flexibility features.

1. Normal ram clearance of 0" to 6" may be increased to any clearance required for special application.
2. Supplementary or replacement cylinders with any ram stroke required are available for quick, easy mounting on same brackets.
3. Rapid socket wrench adjustment cylinder bracket swivels for perfect alignment with work.

Presses are available in ¼, ½, ¾ and 1 ton capacities—for staking, riveting, marking, punching and similar operations.

Write for complete catalog of Air-Arbor Presses and single and double acting Air Cylinders.



AIR-MITE

4417-A West Carroll Ave., Chicago 24

Sperry Hydraulic REMOTE CONTROLS

For AUTOMOTIVE, RAILROAD, MARINE, MACHINE TOOL and COUNTLESS OTHER APPLICATIONS

For example—RHEOSTAT CONTROL

The geared take-off at the receiver shaft is used wherever more than 90° travel is required.

• INSTANT RESPONSE • POSITIVE ACCURATE DUPLICATION MOVEMENT • COMPLETELY SELF-CONTAINED, INDEPENDENT • SINGLE TUBE — EASY INSTALLATION • RUGGED and DEPENDABLE

WRITE NOW FOR COMPLETE INFORMATION or send prints and specs for special applications.

SPERRY PRODUCTS, INC.
711 SHELTER ROCK ROAD,
Danbury, Connecticut
REPRESENTATIVES IN PRINCIPAL CITIES

PNEUMATIC FORMING competes with mechanical

Concluded from page 70

housing to form coils or loops. Cam and limit-switch 6 are now actuated to return the rack to its original position. Cam and limit-switch 7 actuate the top movable die and finishes the hexangular spring in the same manner as the first die at the beginning of the forming cycle. Cam and switch 8 then return both top and bottom dies to their original positions.

Ejection

Cam and switch 9 are next to be actuated and by means of mechanical attachments to the piston rod of another cylinder, the coil forming dogs are released and the finished spring is ejected by the outward mechanical movement of our small plates which pop out of the main face plate.

Cam and switch 10 return the ejector mechanism to its original position and then cam "a" is ready to automatically repeat the complete cycle again. The machine will run continuously through the same cycles unless manually shut off by the master switch.

The formed spring ejected from the machine is completed by joining the two loose ends by welding, knotting, or some form of ferrule.

This machine was completed 9 months ago and has been in use continuously since that time. Other than the replacement of one solenoid valve, it has produced consistently good springs. Maintenance is at a minimum and an operator has very little trouble learning the operation of the machine. The finished machine was built at a nominal cost and is believed to be equally as efficient as a mechanical type forming machine. This is the first machine of its type in a mattress factory and as other problems in wire forming come up, it is apparent that this electro-pneumatic type of mechanism will compete favorably with the purely mechanical type of machines.

TEST STAND DESIGN for selecting piston rings

Concluded from page 76

off the plant compressor which has ample capacity and passes through a pressure regulator to a manually operated air shut-off valve.

From this point on, the same system is used for oil or air at the operator's choice. The medium then passes into an input manifold at which point three input shut-off valves permit application of the medium to any one of three cavities formed by the rings on the test piston. With input valve #1 open, the medium is applied to the top of the piston as would normally be the case. Number 1 air or oil pressure gages will

indicate pressure drop over top test ring only. Leakage drains back to sump.

With output valve #1 open, blow-by or leakage past top ring is directed through a flowmeter which measures specific leakage.

By proper manipulation of the input and output valves, we can check the pressure drop and leakage over 1, 2, or 3 rings, or each ring individually. We can apply pressure to either side of the ring checking it out for double action.

Some of the ring features which we have been able to refine as a result of tests made on this test stand are:

1. Finish on face of ring.
2. Finish on sides of ring.
3. Desirable ring tension and unit pressure.
4. Pressure distribution of ring.
5. End gap.
6. Type of joint.
7. Type of material.
8. Need for ring expanders.
9. Effect of special coatings.

In Figure 2, the test cylinder is at the far right. The operator's hand is on the air regulator. The device mounted in the center of the table is entirely separate from the equipment mentioned above. It is an arrangement to use the test stand for an endurance test of two new types of piston ring coatings. You will note the two horizontal cylinders in which the rings are being tested.

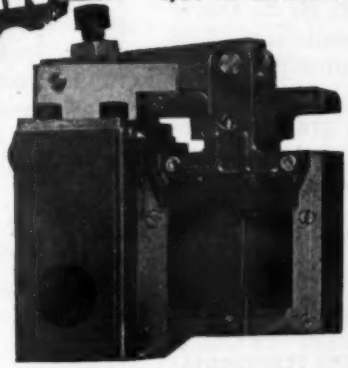
The test stand has proved to be extremely universal, simple to operate, and reliable in results. It has gone a long way toward giving us an answer to the question—How many and what type of piston rings?

NEW HIGH PRESSURE
SOLENOID VALVES

Now available in 110—220 volts 60 cycle A. C. current

Features

- Rugged compact construction.
- 3000 P.S.I. operating pressure
- Continuous duty
- Poppet design eliminates leakage
- May be mounted in any position
- Impregnated coils resist moisture and condensation



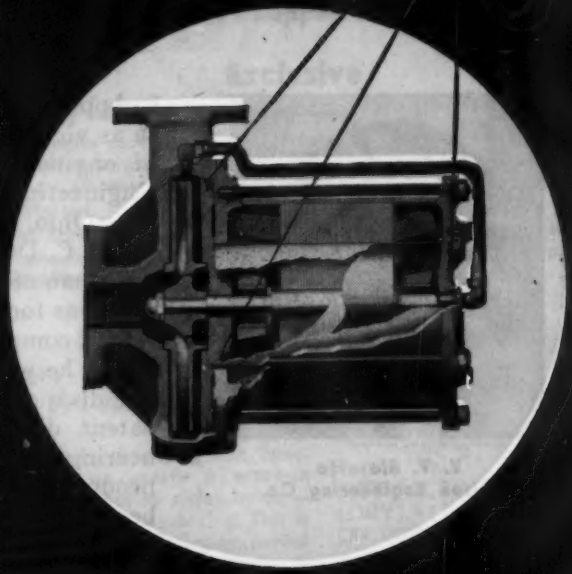
Waterman High Pressure Solenoid Valves are inexpensive, compact units designed for continuous duty in hydraulic systems where pressures are as high as 3000 P.S.I. Poppet type construction gives positive sealing against internal leakage. Impregnated oil resistant coils make these valves suitable for mounting in oil reservoirs. In many cases this feature eliminates costly piping and makes possible the construction of smaller, more compact hydraulic power units. Available in ⅜" and ¾" pipe size.

Write for Illustrated Circular A

WATERMAN ENGINEERING Corp.
725 CUSTER AVENUE
EVANSTON, ILLINOIS

Circle 123 on Reader Service Card

LINEAR
O-RINGS
simplify design . . .



. . . speed assembly of "packingless" pump

Through ingenious use of Linear O-rings, the unique "Chempump" ends all sealing problems. Designed for corrosive liquids, this pump allows pumped fluid to circulate through the rotor chamber... eliminates stuffing boxes and their leakage, adjustment and friction troubles.

Linear O-rings provide the ideal way to put this design idea to work. A pair of them seal off the stainless steel cylinder that surrounds the rotor, and another seals the impeller housing in place. They prevent fluid from leaking into the stator windings, by means of a seal that never needs adjustment . . . takes extremely little space . . . is quick to assemble and disassemble . . . and is far simpler and safer than other packings.

Precision-moulded Linear O-rings are supplied in neoprene, Buna-N, Kel-F and many other natural and synthetic elastomers. Write or call Linear for full information.

"PERFECTLY ENGINEERED PACKINGS"

LINEAR

LINEAR Inc., State Rd. & Levick St., Philadelphia 35, Pa.

Circle 69 on Reader Service Card

Post Scripts of Industry

News about people, manufacturers and sales organizations

V. V. Blasutta
Denison Engineering Co.

Appointment of **V. V. Blasutta** as vice president and director of engineering of the **Denison Engineering Company,** Columbus, Ohio, has been announced by W. C. Denison, president and chairman of the board. Mr. Blasutta was formerly chief engineer of the company. In his new capacity he will direct activities of five divisions, in quality control, patent division, research engineering, general engineering and product development. He has been with the firm since 1940 and has been chief engineer since 1941.

R. H. Parduhn
The Oilgear Company

The Oilgear Company has announced the appointment of **E. H. Parduhn** as district engineering representative in charge of the Pacific northwest. The former representative, **R. E. Davis** of Portland, has been recalled to the home office to undertake special engineering assignments. Mr. Parduhn is a graduate mechanical engineer of the University of Wisconsin and has served in the United States Air Force. He has worked in the Oilgear engineering, service and sales departments since 1946. During the past four years, he has been the Los Angeles area representative.

Jim Hawkesworth
Graton & Knight Company

Jim Hawkesworth has been appointed district manager in charge of the San Francisco branch of the **Graton & Knight Company** in Worcester, Mass. In this capacity, he will direct sales operations for the entire Pacific coast area. Mr. Hawkesworth formerly covered the northwestern states. He has been associated with the company since 1913.

Central Mine Supply Co., has announced the addition of a new department, devoted to the manufacture of hose coupling and assemblies.

Alton D. Anderson has been named chief engineer of the **Cook Research Laboratories,** Division of Cook Electric Company, Chicago, Ill. Mr. Anderson succeeds D. C. MacDonald who resigned. Mr. Anderson is well known for his work in undersea weapons. He spent over 10 years as a research engineer with the Naval Ordnance Laboratory in this field. Since coming to Cook in 1950, Mr. Anderson has been director of the systems development section and most recently as chief engineer. Also at Cook **Earl L. Washburn** has been named technical head of the systems development section. Prior to coming with Cook, Mr. Washburn was a senior project engineer for over seven years, with Wallace Tiernan Products Company. In his new position, Mr. Washburn will be in charge of all engineering phases of geophysical and physics as well as digital computing equipment.

R. J. Minshall, president of **Pesco Products Division,** Borg-Warner Corp., at Bedford, Ohio, announces the appointment of **Paul W. Brannon** as vice president of manufacturing. Mr. Brannon has been associated with Pesco Products since November 1952 and more recently in the capacity of manager of manufacturing. Mr. Brannon's new responsibilities will include all manufacturing and procurement of materials.

The Fall Wiper Ring

Keeps The Piston Rod Clean!

Since 1944—Spring-Loaded with "Squeeze Grip Action" and (dry) Lapped True Circle

Used During World War II and ever since by the Military

Fall Wiper Rings Spec. MIL-S-5049 are AN Approved.

Squeeze Grip Action Does It

The 3-piece Fall Wiper Ring assembled into one piece as covered by patents consists of (1) a one-piece Split Wiper Ring (body) with two flanges or groove in its O.D.; (2) a one-piece split compressor spring assembled in the groove (3) an endless cover band surrounding the spring in the groove which causes a squeeze grip action on the piston rod.

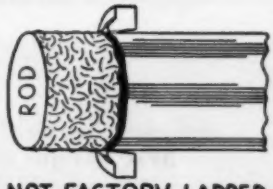
The Fall Wiper Ring is available from ½" to 13" dia. Military part numbers from AN6231A1 to AN6231A71. Write, wire or phone us regarding your wiper needs.

Exclusive Spring-Loaded "Squeeze Grip Action"—

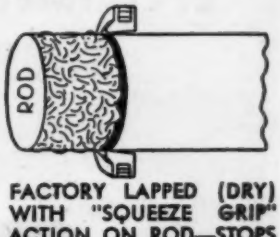
1. Eliminates spotty or erratic contact on rod.
2. Provides longer life because the spring in the "Squeeze Grip" takes up all wear, while the light-tight wiping edge continues to grip the rod.
3. The Spring Loaded "Squeeze Grip" Action on the rod is exactly the same for any number of rings of a given size because the pounds of **breakout friction** is individually controlled in each ring.

Exclusive Factory Lapped (dry) by Pre-Actuating

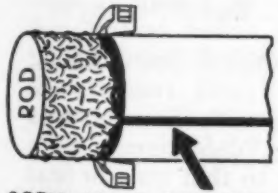
In addition to complying with Spec. MIL-S-5049, we create a **worn-in** true circle contact on piston by carefully pre-actuating each ring. This is done to avoid a wearing-in period after the ring has been installed . . . a period during which the ring might not completely contact the piston with the possibility that small metal fragments would wear off and enter the packing gland. This pre-actuating process is used by us exclusively and insures **immediate true circle contact,** from moment of installation. Only when the Spring Loaded "Squeeze Grip" action and Factory Lapped (dry) features are combined can full wiper contact and a light-tight wiping edge be assured. (See Illustration above, right.) This full wiper contact is long-lived because the spring in the "Squeeze Grip" action takes up the wear while the light-tight wiping edge continues to grip the rod.



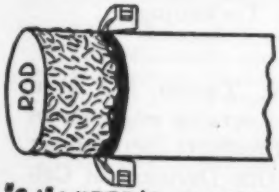
NOT FACTORY LAPPED (DRY) - LEAVES DIRT ON ROD



FACTORY LAPPED (DRY) WITH "SQUEEZE GRIP" ACTION ON ROD—STOPS PASSAGE OF DIRT (except at Joint)



OPEN JOINT PERMITS A STREAK OF DIRT AT JOINT OPENING



"CJ" WIPER'S CLOSED JOINT KEEPS THE ENTIRE ROD CLEAN

The FALL "CJ" Closed Joint Wiper Ring

Another First for FALL Wiper Rings! The FALL "CJ" Closed Joint Ring has been especially designed for those applications requiring absolute freedom from dirt passing through joint of ring to bearings or packing. (See illustations at left.) This FALL Closed Joint ring has the same Spring Loaded "Squeeze Grip" Action and Factory Lapped (dry) wiping edge as our regular 3-piece "3C" type ring and functions exactly the same BUT with the added assurance that NO dirt passes through the joint. Patented and other patents pending.

FALL "3C" three-piece Wiper Rings are available in all sizes to including 13" diameter. FALL "CJ" Closed Joint Wiper Rings are available in certain sizes now, other sizes soon. Our engineering staff will gladly work with you in solving your wiper ring problems. Write, wire or phone us.

Ace Products Company

P.O. Box 784 Toledo 1, Ohio Phone ADams 6513

All Fall Wiper Rings are covered by patents issued and patents pending.

Fall Wiper Ring SPRING LOADED

Post Scripts of Industry

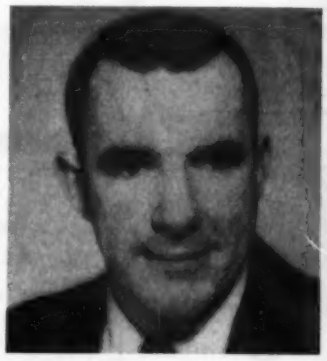
Continued

Appointment of **L. E. Blackwell, Jr.**, sales application engineer with the **Reliance Electric and Engineering Company**, Cleveland, Ohio, to the Charlotte, N. C. sales office, was announced jointly by E. E. Helm, sales vice president and E. G. Orahood, southeastern district manager, Atlanta. In his new field sales post, Blackwell will report to Frank W. Leitner, Charlotte branch manager. Blackwell joined the Reliance organization in 1952 following graduation in electrical engineering from Duke University. He served in the United States Navy during World War II.

Announcement is made of the appointment of **Everett W. Lundy**, assistant sales manager, **Peerless Pump Division**, Food Machinery and Chemical Corporation, Los Angeles, by B. A. Tucker, general sales manager. Lundy, previously Pacific district manager for the pump firm, will be succeeded by **Rober H. Hull**, presently Peerless' central district manager at Indianapolis. Hull, in turn, will be succeeded by **Waldo T. Harman**, Chicago branch office manager. Lundy attended the University of California.

With completion in October of an addition to its Memphis, Tenn., plant, **Flexonics Corporation** will transfer brass bellows production to Memphis from the pilot plant at Elgin, Ill., John F. P. Farrar, president has announced. **Norman Dawson**, who has been quality control manager at Elgin, becomes superintendent of the Brass Bellows Division at Memphis. **Frank Brence** continues as Memphis factory manager.

Engineers agree that the BEST designs are the SIMPLEST
EFFICIENTLY SIMPLE
TRADE MARK
"FULFLO"
REG U S PAT OFF
OIL BY-PASS RELIEF VALVES
BRASS OR CAST IRON Standard or Flange Types
To maintain specific, predetermined pressures on machine tool hydraulic mechanisms, ram presses, Diesel and oil burning equipment
NON-CHATTERING...NO MAINTENANCE
for pressures from 5 to 500 lbs. Pipe sizes from ¼" to 2".
WRITE on your letterhead for your personal, professional copy of
FULFLO MECHANICAL DATA BOOK
Please state if for Pumps—for Valves—or for both.
FULFLO
THE FULFLO SPECIALTIES CO. Inc.
BLANCHESTER, OHIO



George B. Furey
Honan-Crane Corporation

The appointment of **George B. Furey** to the **Honan-Crane** sales engineering staff has been announced by D. J. Jones, the company's general manager. With headquarters at Honan-Crane's main office in Lebanon, Ind., Furey will cover central and northwestern Indiana including South Bend and Indianapolis. He has been with the company's engineering department since 1952. Prior to that time he was bulk materials handling engineer for Link-Belt. He has studied at Iowa University and the Illinois Institute of Technology.

Frank W. Turner has been named sales service engineer of the Marco Products Department of the Plastics Division of **Celanese Corporation of America**. Mr. Turner, who has a long record of achievement as engineer and technical sales representative in the chemical apparatus field, is being transferred from

Circle 99 on Reader Service Card

Introducing...

the SKINNER V10

MINIATURE PRECISION HYDRAULIC VALVE

Skinner's new V10 Series Miniature Hydraulic Valve is an amazingly compact unit, capable of handling pressures up to 1000 P.S.I.

This precision-made valve is ideally fitted for use in the automatic operation of single and double acting hydraulic cylinders, and in pilot control of larger three and four way hydraulic valves.

The V10's construction is consistent with the Skinner quality tradition: most internal parts are of stainless steel; the slide mechanism has a precision-ground piston, and a bore honed to extremely close tolerance, thus minimizing leakage.

Specifications: 1/8" NPT threaded ports; effective orifice diameter of 3/32"; available in the full range of AC and DC voltages.

The economical design and unusually small size of the Skinner Miniature Hydraulic V10 valve will enable many manufacturers to install it in places where, heretofore, remote control devices have been considered impractical.

SKINNER ELECTRIC VALVES

Skinner ELECTRIC VALVE DIV.

THE SKINNER CHUCK COMPANY

105 Edgewood Ave., New Britain, Conn.

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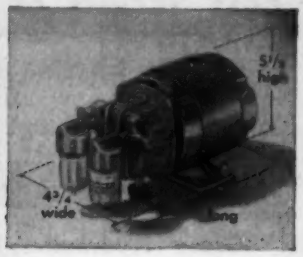
Circle 37 on Reader Service Card

Announcing Two Compact

NEW GAST ROTARY Integral-MOTOR AIR PUMPS

FOR ORIGINAL EQUIPMENT APPLICATIONS AND PORTABLE USES



Note the compactness! Yet these Integral Motor-Pumps (basic Model No. 0406 shown) deliver .6 CFM—to 15 PSI or 25 inches Vacuum. 1750 RPM with 1/12 HP G.E. Motor.

It's a VACUUM PUMP! For vacuum, Model 0406-V2-154X has already proved its advantages as a component of industrial instruments requiring air flow; as a portable air sampler, etc.

It's an AIR COMPRESSOR! For pressure, Model 0406-P2-154X is in use on special machines for textile wear testing; as a laboratory compressor, etc.

Both OIL-LESS AND STANDARD LUBRICATED TYPES OFFERED—VARIOUS ACCESSORIES

Write FOR NEW DATA SHEETS on 0406 Integral Motor-Pump Models.

You can get absolutely oil-free air with completely oil-less models (never need lubrication); also standard lubricated models. Altogether, Gast offers a wide range of Integral Motor-Pump Models from 1/12 to 1/3 HP. *Investigate now!*

Same model, but with handle, gauges, nipples, etc., to show typical accessories we can furnish.

Original Equipment Manufacturers for Over 25 Years

GAST ROTARY AIR MOTORS · COMPRESSORS · VACUUM PUMPS

(TO THREE H.P.) (TO 30 LBS.) (TO 28 INCHES)

GAST MANUFACTURING CORP., 131 Hinkley St., Benton Harbor, Mich.

UNBRAKO®

dryseal-thread PRESSURE PLUGS

seal tight

without compound

When UNBRAKO Pressure Plugs are tightened, major and minor diameters are positively sealed, pressure tight without sealing compound. UNBRAKO Dryseal-Thread Pressure Plugs, in a full range of sizes from ⅛" to 1¼" NPTF, are available from your local UNBRAKO distributor's stocks. Write for literature. SPS, Jenkintown 2, Pa.

Our Fiftieth Year : A START FOR THE FUTURE

UNBRAKO SOCKET SCREW DIVISION SPS JENKINTOWN PENNSYLVANIA

Use

POWERMATIC AIR HYDRAULIC PUMPS

For Safe, Positive, Accurate Pressures to 25,000 p.s.i.

Size 9½" x 14" high
Weight 35 pounds

LONG LIFE
LOW COST
SMOOTH
FAST
PORTABLE

The air operated Powermatic hydraulic pump is engineered for continuous service at maximum capacity without overheating or overloading. Provides positive variable pressure control. Streamlined —no protruding parts to catch or damage. Hundreds of uses—operating rams, jacks, pipe benders, presses, hydraulic body and frame straighteners, lab testing, etc. Send for catalog and prices.

Distributors Inquiries Invited

POWERMATIC INC

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Continued

the central engineering department of the company to assume his new duties at the Marco Products plant in Linden, N. J.

Greer Hydraulics, Inc., announces the appointment of **Carleton Kinne** as assistant to company president Edward M. Greer. Mr. Kinne will be engaged in the development and installation of hydraulically operated hatch covers on merchant and naval ships. Mr. Kinne was formerly with the United States Lines as engineer afloat the SS Washington and SS America. As Commander in the United States Navy, he served as assistant to the inspector general of Military Sea Transportation Service. He is a Marine Engineer graduate of the New York State Nautical College. Also at Greer **William J. Cunningham** has been named assistant sales manager for Industrial Hydraulic Accumulators and components. Mr. Cunningham was formerly with Dumont Aviation Associates in charge of government contracts negotiations. He served with the Aircraft Production Resources Agency at Wright-Patterson Field.

Carleton Kinne
Greer Hydraulics, Inc.

William J. Cunningham
Greer Hydraulics, Inc.

The **Heat-X-Changer Co., Inc.** of Brewster N.Y. has announced the appointment of **H. C. Halbert** as industrial sales representative in the territory covering Tennessee, Alabama, Georgia and Florida. Mr. Halbert has been in the compressed air field for over 30 years.

Fred T. Miller, vice president of **Adel Division,** General Metals Corporation, has announced the appointment of **Philip A. D'Ambrogi** as engineering service representative working out of the newly established office, Dallas, Texas. D'Ambrogi was previously associated with Glenn L.

BOOST PUMPS
High Pressures
Low Prices
SPRAGUE
Measures
8¼" wide x 9⅝" deep.
Boost 100 PSI. air pressure to 10,000 PSI. fluid pressure for $173.25 (FOB Gardena, Calif.). Eight standard models for output fluid pressures of 1,000 to 30,000 PSI. Special models for lower or higher pressures.
Applicable wherever low volume output at high pressures is the requirement. For oil or water service. Complete power packages also available. Send for bulletins.
Assembly No. | Ratio | Maximum Fluid Pressure | Prices, F.O.B. Gardena, Calif.
216-C- 10 | 10:1 | 1,000 PSI. | $220.00
216-C- 20 | 20:1 | 2,000 PSI. | 210.00
216-C- 35 | 35:1 | 3,500 PSI. | 173.25
216-C- 60 | 60:1 | 6,000 PSI. | 173.25
216-C-100 | 100:1 | 10,000 PSI. | 173.25
216-C-150 | 150:1 | 15,000 PSI. | 194.50
216-C-200 | 200:1 | 20,000 PSI. | 225.00
216-C-300 | 300:1 | 30,000 PSI. | 289.50
SPRAGUE
Engineering and Sales Corp.
1144 West 135th Street, Gardena, California

Martin Company, with whom he has been field service representative for the past twelve years, concentrating on aircraft pressurization, hydraulic and electrical systems. The Dallas office will serve Texas, Arkansas, Louisiana and the Tulsa, Oklahoma area. Adel also announces the appointment of **Walter J. Hyatt** as engineering service representative in the southern California and Arizona area. Formerly with Lockheed Aircraft Corporation and Pacific Airmotive Corporation and with a background in engineering, sales and customer service, Hyatt has been directly associated with aviation activities for the past fifteen years. He will work out of Burbank, Cal. office.

Airway Products, Incorporated, announces **H. R. (Hank) Greenley's** appointment as a vice-president and general sales-manager. Greenley brings to Airway Products Inc., more than sixteen years of experience in the automotive and industrial

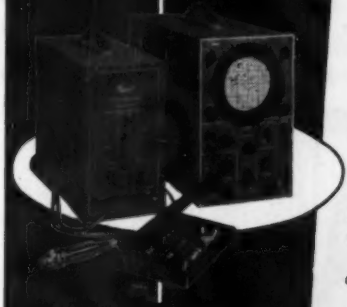
Circle 30 on Reader Service Card

FOR DYNAMIC PRESSURES

NO OTHER Pressure-Measuring Device COMPARES with

Electro ELECTRONIC EQUIPMENT Pressuregraph

Here's why



- Measures dynamic pressures.
- Drift stabilized.
- Temperature stabilized.
- Linear output for unit pressure change.
- One pick-up for all pressures.
- Balanced output for driving DC recorders.
- No need for pre-amplifiers to drive recorders or oscillographs.
- Simple operation.
- Records pressure transients as short as 50 micro-seconds.
- Can be water-cooled for temperatures exceeding 1000° F.
- Auxiliary Synchro-Marker adds 2 channels (timing and positioning) on pressure curve.
- Up to 200 feet of pick-up cable can be used.
- Flush-head type pick-up available . . . stops cavity effects.
- Auxiliary pick-up standard assures correct adjustment for all diaphragms.
- Time proved by internationally known industrial concerns, universities and research laboratories.
- Reasonably priced.

Bulletin listing varied applications and specifications on request.

EPL Field Engineers Throughout the Country Available to Help Solve Your Pressure Problems

ELECTRO PRODUCTS LABORATORIES

4501-Hp Ravenswood Ave., Chicago 40, Ill. • *Canada:* Atlas Radio Corp., Ltd., Toronto, Ont.

WAR SURPLUS SAVINGS

SAVE UP TO 85%

NEW INSIDE – OUTSIDE VERNIER CALIPERS

German made by one of Europe's leading specialists in precision tools. Measures inside-outside & depth in .001" to 6" in 1000ths and 1/10mm to 150mm in 10ths. 9.75
MICROMETERS – 0" to 1" in 1,000ths. Has lock-nut & ratchet ...ONLY – . . . 9.75

STAND MAGNIFIER

Handy stand magnifier with universal adjustments. Overall height: 6". Has powerful, clear magnifying lens. 1.99

BENDIX HYDRAULIC PUMP & MOTOR

Has 3-1/2 GPM capacity at 600 PSI. Motor is 1½ HP, 24V, D.C. Will operate on either 12 or 32V, DC current. Has built-in relief valve adj. to 1500 PSI. This unit ideal for hyd. lifts, portable loaders, etc. 19.50

MAGNETIC BASE – INDICATOR HOLDER . . .

A time saver for precision checking. Magnetic base fits curved or flat surface. Has 45-50 lb. pull. Stainless steel 6½" rod mounted in ball socket permits universal settings 3.95

Note: We have complete line of instruments, depth gauges, inspection mirrors, etc. WRITE TODAY

HYDRAULIC HAND PUMP

Operating pressure 2000 PSI. Cap., 1.5 cu. in per complete cycle . . 12.75

GEAR HEAD MOTORS

Heavy duty, G.E. Gear Head motor. 2 HP, 24V. DC, 125 amp., reversible motor drives a reduction gear unit giving 36 to 1 ratio at take-off. Also will operate on 6 or 12 volts.

36 to 1 G.E. (306 shaft RPM)
28 to 1 Eclipse (130 shaft RPM)
40 to 1 Eclipse (110 shaft RPM) 10.95 EA.

HYDRAULIC ACCUMULATORS

A–2B FLOATING PISTON TYPE – 4"x 18" Built to stand 2,000 PSI 12.75

A–5 VICKERS – 10" dia. Ball type. Built to stand 2000 P.S.I. 24.75

ELECTRIC ACTUATORS

Hundreds of uses for any mechanical device needing controlled 2 way action. Opens, closes, raises or lowers doors – windows – gates – valves. CTU-2 – Foote Linear Actuator – 24 volt, DC, 6500 RPM, 1/6 HP – series wound motor. 4½" stroke in 13½ sec. Compression and tension loads up to 750 lbs. Adjustable micro switch for limits of travel. Overall lngth., retracted 11" 7.95

We also carry many more sizes and types of Actuators. Write today for information.

HYDRAULIC CYLINDERS

Gives 20,000 lb. thrust (push or pull) using 1500 PSI line pressure as obtained from our hydraulic pumps. Will produce up to 40,000 lb. thrust with 3000 PSI. Can also be used on low pressure air systems. 4" bore; 18" stroke; 30½" length. Ideal for road farm – shop machinery. 29.75

No. 3 HYDRAULIC CYLINDER

Double action. Bore is 1" – Shaft ½". Has stroke of 2½" to 4". Stroke can be adjusted with internal sleeve stops. Overall length is 8½". Will take 1500 lbs. continuous duty. 3000 lbs. intermittent. Will lift or push up to 1100 lbs. 5.75

We stock over 50,000 Hydraulic Cylinders, Valves, Pumps, Accumulators, Hand Pumps, Motors, Hose, etc. All at Money Saving Prices.

230 Pg. CATALOG

Amazing Value! 1000's of items for Mfr., Mechanic, Sportsman, etc. Save on Machine Tools, Hydraulics, Pumps, Valves, Hand & Power Tools, Instruments, etc. Send for your copy today!

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Order from this ad. Pay by M.O. or check. P.O.'s accepted from D&B formula deposit with C.O.D.'s.

ULRIX

QUICK COUPLERS
For All Hydraulic Lines

What's Your Hydraulic Line Problem? There's an answer in the ONLY COMPLETE SELECTION

ULRIX offers a model and size for any problem — standard and break-a-way types. ULRIX QUICK COUPLERS connect under pressure without tools. WRITE for FULL DETAILS.

ULRICH MFG. CO. ROANOKE, ILL.

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Circle 115 on Reader Service Card

Continued

power transmission engineering, sales and merchandising field. Other appointments at Airway include: George D. Gareau, general purchasing agent; A. L. Modreski manager of production. Gareau was recently with the Ford Motor Company Tank Division purchasing group and brings more than ten years of purchasing experience.

Acme Gauge & Instrument Co., Inc. announce recently appointed distributors: Rousseau Controls Ltd., 2215 Beaconsfield Ave., Montreal 28 Que., Canada; Shively Bros. Inc., 719 E. Second Ave., Flint 3, Michigan; Fluid Power Equipment Co., Inc., 3320 N. Green Bay Ave., Milwaukee 12, Wisconsin; Genesee Machine Builders Inc., 1732 Hudson Ave., Rochester 21, N. Y.; Garden City Instruments Inc. & Affiliates J. H. Havens Co. and A & A Instrument Co., 608 South Dearborn St., Chicago, Ill.

Matthew Bauer, vice president and general manager of the **Flodar Corporation**, Cleveland, Ohio, announces the appointment of the **Wilkes Company**, 4013 Milwaukee Ave., Chicago, Ill., as representative in the northern half of Illinois. The company is headed by brothers, **Donald F.** and **Frederick R. Wilkes.**

Merrill A. Hayden has been promoted to assistant general manager of **Waterbury Tool, Div., of Vickers Inc.** He will continue his duties as general sales manager which he assumed in 1950 after transferring from Vickers Inc., in Detroit. Mr. Hayden has been with Vickers since 1935.

R. G. Holben
Conoflow Corporation

R. B. **Werey**, president **Conoflow Corporation**, announces the promotion of the following members of the company's administration staff. **Ralph G. Holben**, former production manager, has been elevated to the position of plant manager. Mr. Holben's new duties will involve supervision of all plant activities including production, purchasing and maintenance of plant facilities. **Horace C. Shuman**, former assistant to Mr. Holben, will assume the duties of production manager. Mr. Shuman has a background of twenty years in production work with Conoflow

Equip your valves for
AUTOMATIC PROCESSING
REMOTE CONTROL
POWER OPERATION

(Above) High Pressure Gate Valve with Ledeen Valve Actuator.
(Left) Ledeen Tandem Type Valve Actuator on Standard Plug Valve.

with
Ledeen VALVE ACTUATORS

★ Simple, Rugged Construction.
★ Few Moving Parts.
★ Easily Installed.
★ Prompt Delivery.

These actuators are for the automatic operation of gate, diaphragm, plug and other line valves, and are pneumatically or hydraulically operated for direct or remote control. Designed as package units, they are mounted directly on the valves without need of special manifolds or outside supports. They are easily, quickly and rigidly installed on new valves or on valves in service.

Ledeen Valve Actuators provide positive operation, permit automatic processing, safety installations, multiple central control ,and require a minimum of maintenance. WRITE FOR BULLETIN 3000.

VALVES • CYLINDERS
VALVE ACTUATORS
AIR HYDRAULIC
PUMPS & BOOSTERS

Ledeen Mfg. Co.
1610 SO. SAN PEDRO STREET
LOS ANGELES 15, CALIFORNIA

and SKF Industries where he was previously employed as assistant to the plant manager. **Harold W. Bonekat** was named purchasing agent in the announcement. Mr. Bonekat, who joined the company in 1951 as a buyer, was formerly employed as a buyer, at General Electric's Switchgear Division in Philadelphia.

Russell J. Smith, who heads up a sales organization bearing his name located in St. Louis, was recently named sales representative of **Snap-Tite, Inc.** Union City, Pa. Mr. Smith, who has over 30 years sales and manufacturing experience, and his four man team cover the states of Illinois, Kentucky and Missouri, often using their company four passenger plane.

William J. Thomas, general sales manager, has been appointed general manager of the **Tubular Products Division** of The Babcock & Wilcox Company and **Paul J. Utnehmer,** works manager, has been named to the board of directors of the division. Mr. Thomas has been with the company since 1932. He was associated with the Boiler Division at Barberton, Ohio until 1941 when he left his position as assistant manager of the process equipment department to join the Tubular Products Division. Mr. Thomas is a graduate of Carnegie Institute of Technology. Mr. Utnehmer has been with Babcock & Wilcox since 1945.

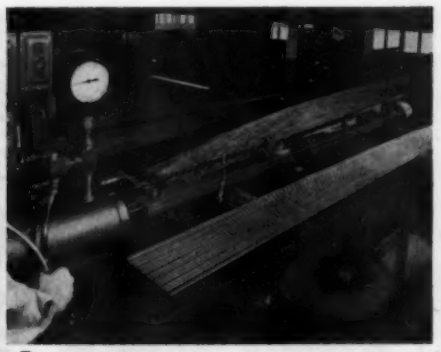
James F. Davis has been appointed purchasing agent for the industrial hydraulics division of **The Parker Appliance Company** in Cleveland, Ohio.

The election of new officers on the board of directors of the **C. A. Norgren Co.** was announced following a board meeting. **C. Neil Norgren,** assistant general manager, was elected vice president and secretary. **Aksel Nielsen** was made vice president and assistant treasurer. **Leigh H. Norgren,** plant superintendent, was elected treasurer and assistant secretary. **Floyd R. Pool** was made assistant secretary. Neil Norgren has been associated with the company for eleven years, being in charge of purchasing and credit prior to his present assignment as assistant general manager. Leigh Norgren was industrial engineer with the company prior to his appointment as plant superintendent nearly two years ago. Both are sons of the founder and president of the company.

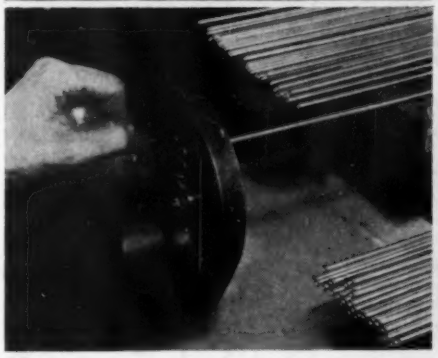
Bruce B. Allen, manager of the Summit Research Laboratories of **Celanese Corporation of America,** announced the following appointments, **Raymond A. Gobeil** as head of the physical testing laboratory; **Joseph A. Berg,** as head of personnel administration and **Harold K. Haviland** as associate head of the technical information section.

Rudolph F. Gagg has joined the administrative staff of Ray-

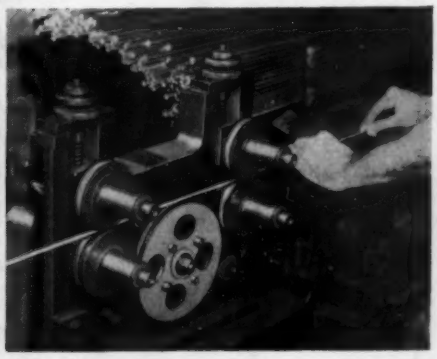
If you can't place your hydraulic tubing in all 3 of these pictures it isn't SUPERIOR hydraulic tubing



1. HYDROSTATIC TEST—Every single length of Superior hydraulic quality tubing is 100% hydrostatic-tested. This is only possible, economically, because of Superior's invention of a super-speed clamp.



2. FLAREABILITY TEST—Each order of Superior hydraulic tubing is sampled for flareability. Superior's low-carbon Hydraulic Tubing (0.12% maximum) greatly increases ease of flaring and bending.



3. MARKING—Every length of Superior hydraulic tubing is marked with indelible ink so that you cannot mistake that it is hydraulic quality and its source is Superior.

Superior low-carbon Hydraulic tubing is specially made to attain a non-aging tubing with low ultimate tensile strength and high elongation for good ductility.

Sizes available from all Superior distributors—.125" to 1.125" O.D. Temper #1, dead-soft annealed, Bulletin 38 will bring you complete information on analyses, sizes, lengths, properties, and recommended working pressures. Use the coupon.

Superior
THE BIG NAME IN SMALL TUBING

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2030 Germantown Ave., Norristown, Pa.

Please send me at once your newest folder on Superior Hydraulic Tubing.

Name_____
Title_____
Firm_____
Address_____
City_____ Zone____ State_____

Continued

mond P. Lansing, vice president and group executive of **Bendix Aviation Corporation.** Gagg, recently president of Air Associates, Inc. and previously assistant to the general manager of Wright Aeronautical Corporation, will assist Lansing in the administration of the seven Bendix divisions. Prominently identified with the aviation industry for 23 years, Gagg joined Wright's in 1930. He is a graduate of the University of Colorado and was a graduate student and a teacher at the Sheffield Scientific School, Yale University. He is a member of several professional groups and is at the present time president of United Engineering Trustees.

Formation of three companies is announced by **Hugh H. Dorman. Olivet Manufacturing Co.**, headed by Mr. Dorman, is established to fabricate tubing assemblies. **Maeward Mfg. Co.** will produce hose assemblies and **Automatic Machine Products, Inc.**, is manufacturing special fittings and manifolds. All three companies are located in Olivet, Michigan.

Ernest F. Klessig
Airway Products, Inc.

J. L. Stinson, president and general manager of **Airway Products, Incorporated,** announces **Ernst F. Klessig's** appointment as director of engineering. "Ernie", who was formerly executive design engineer at Vickers, made a major contribution to the automotive industry, on the design of a power steering pump. Mr. Klessig is a graduate of Marquette University and is a member of SAE and The Engineering Society of Detroit.

A new manufacturing company, the **Fluid Regulators Corp.**, Mentor, Ohio, was organized by principals of Fluid Controls, Inc. The new company has been licensed to manufacture certain hydraulic valves and devices by Fluid Controls, Inc. Fluid Regulators Corp. will establish its own administrative, engineering, purchasing and sales departments. Officers include: president, **Donald A. Stark**; executive vice president, **Frank S. Schindler**; vice president in charge of production, **Paul Lisby**; secretary, **O. G. Lear**; and treasurer, **Donald E. Rust.** Active management of the new organization will be handled by Mr. Schindler,

Goshen Rubber presents
RING CHAMPS to remember!
JIM CAME CLOSEST OF ANY HEAVYWEIGHT CHAMP TO RECAPTURING THE TITLE...
IN 1900 HE FOUGHT JIM JEFFRIES AND WAS WINNING FOR 22 ROUNDS WHEN JEFF CAUGHT HIM ON THE ROPES IN THE 23RD AND KO'D HIM... HAD JIM BEEN MORE CAUTIOUS, THE TITLE WOULD HAVE BEEN HIS FOR THE SECOND TIME
James J. CORBETT
"THE SUPREME BOXING MASTER"
—FIRST SCIENTIFIC BOXER!
JIM LOST THE CHAMPIONSHIP IN 1897 TO BOB FITZSUMMONS
CORBETT, THE ACME OF CLEVERNESS, WAS NIMBLE FOOTED AS A DEER AND OWNED ONE OF BOXING'S SPEEDIEST LEFT HANDS
—HE WON TITLE IN 1892 WHEN HE CONQUERED THE BOASTING SULLIVAN IN 21 ROUNDS.... HE FEINTED, SIDESTEPPED AND JABBED JOHN L. DIZZY!
In this Corner..... "O" RING CHAMP
GRC "O" RINGS ARE MADE TO MIL AND COMMERCIAL SPECIFICATIONS FROM BATTLE PROVEN SYNTHETIC AND SILICONE RUBBER COMPOUNDS TO MEET A WIDE RANGE OF CONDITIONS
HE HAD BEEN A BANK CLERK IN SAN FRANCISCO BEFORE ENTERING THE RING—
Goshen Rubber Company INC.
MOLDED • DIE CUT • LATHE CUT RUBBER SPECIALTIES SINCE 1916
1511-3 S. TENTH ST.
GOSHEN, INDIANA

who prior to his new assignment was assistant chief engineer, and Mr. Lisby, former plant superintendent of Fluid Controls, Inc.

J. E Ashman, president of **Air Associates, Incorporated,** Teterboro, N. J., announced several promotions in the Aircraft Products Division of the corporation. **Marvin J. Parks** has been appointed customer relations manager on the president's staff. New assignments in the Aircraft Products Division are, **Edmund B. Parke,** general manager; **Douglas A. Morrison,** sales manager; **Charles Gaver,** assistant sales manager; **Walter Stubbs,** engineering manager and **Raymond Hart,** chief inspector.

Lindberg Engineering Company, Chicago, has moved its Air & Hydraulic Division from the main plant to 225 N. Laflin Street, Chicago, Ill., to increase manufacturing facilities for the production of air and hydraulic cylinders and related equipment. Expansion plans directed by **L. A. Shea** include the addition of new products to the present line of cylinders. New agents are being added to complete national sales coverage.

Ernest Nuber has been appointed sales manager, instrument division of **The Bristol Company,** Waterbury, Conn., according to an announcement by H. E. Beane, vice president of sales. Mr. Nuber joined the Bristol sales engineering organization in 1929. He was made Pacific coast manager in 1934 and later served for several years as export manager. In 1948 he was promoted to the position of manager, application engineering department. He will continue to maintain his headquarters at the company's main office at Waterbury.

New sales manager-aircraft operations for **Pacific Airmotive Corporation** is **J. D. Stricklan,** according to announcement by L. B. Littrell, vice president.

THE MARKET PLACE

Classified Ad Rates

Rate for "Positions Wanted" ads is $5.00 per column inch. For all other classifications, $20.00 for the first column inch and $15.00 for each additional inch.

FOR SALE
Due to ill health

Well equipped leather packing business established sixteen years, all types up to 10 inch. Will lease or sell building. Unlimited opportunities for a man with ambition and the know how. Box 10253
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FOR SALE

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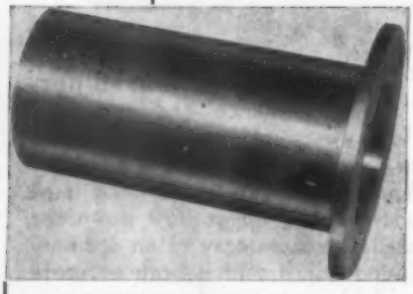

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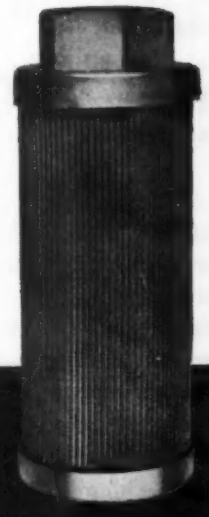

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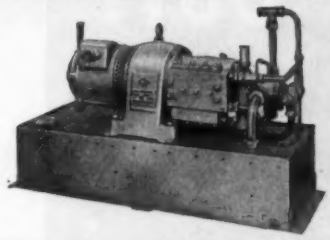

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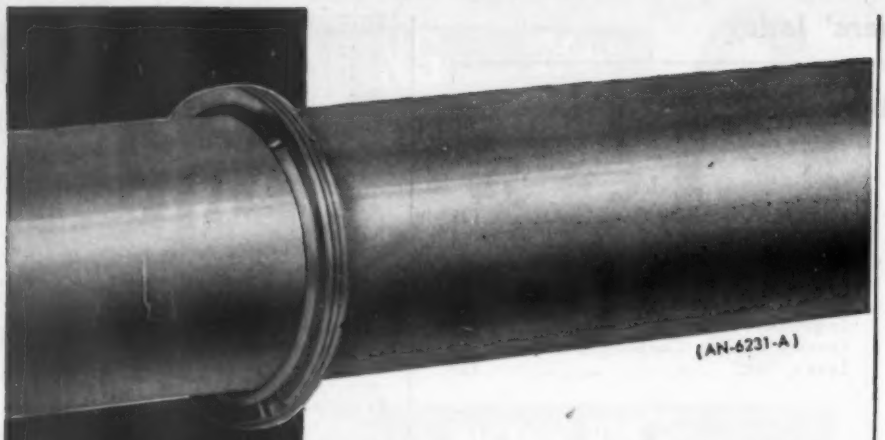

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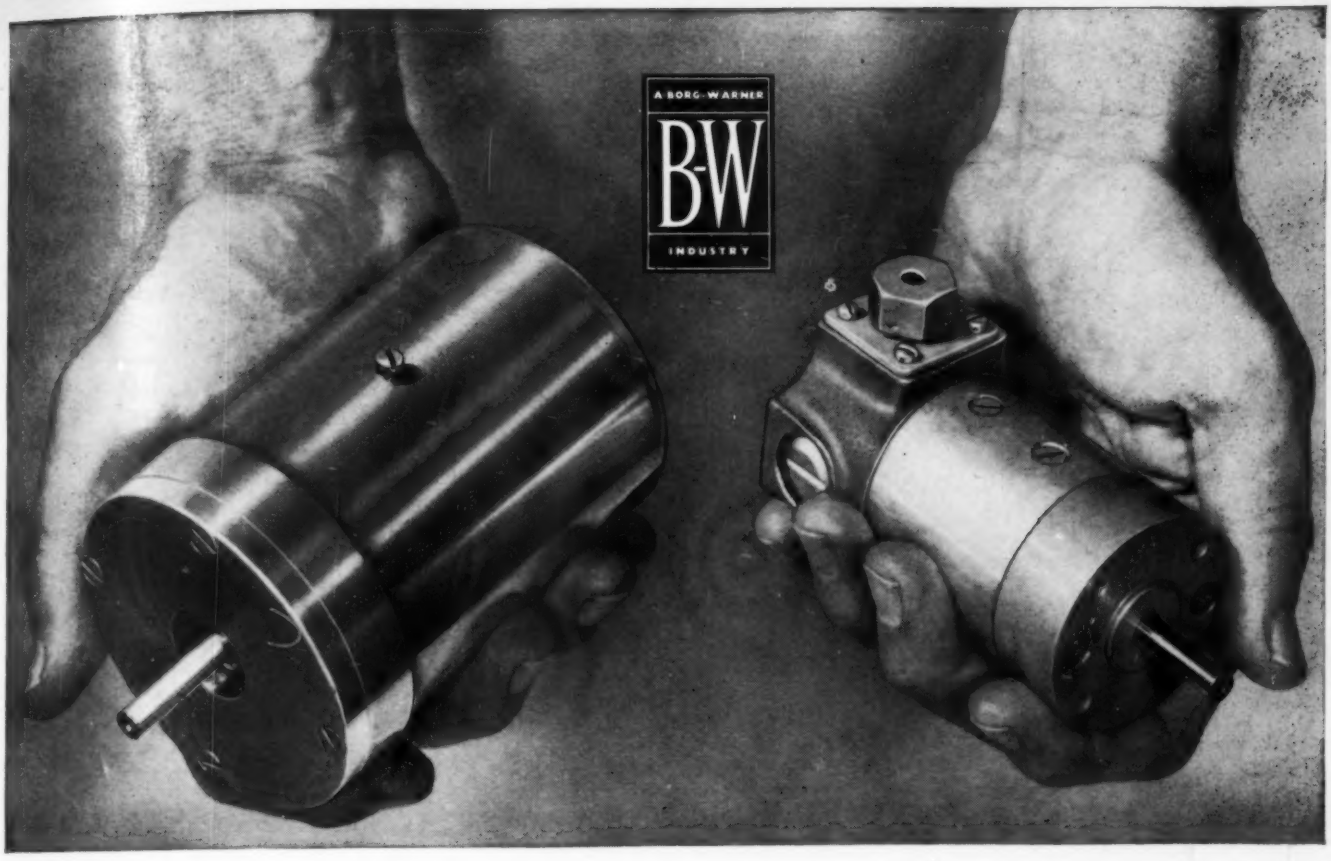

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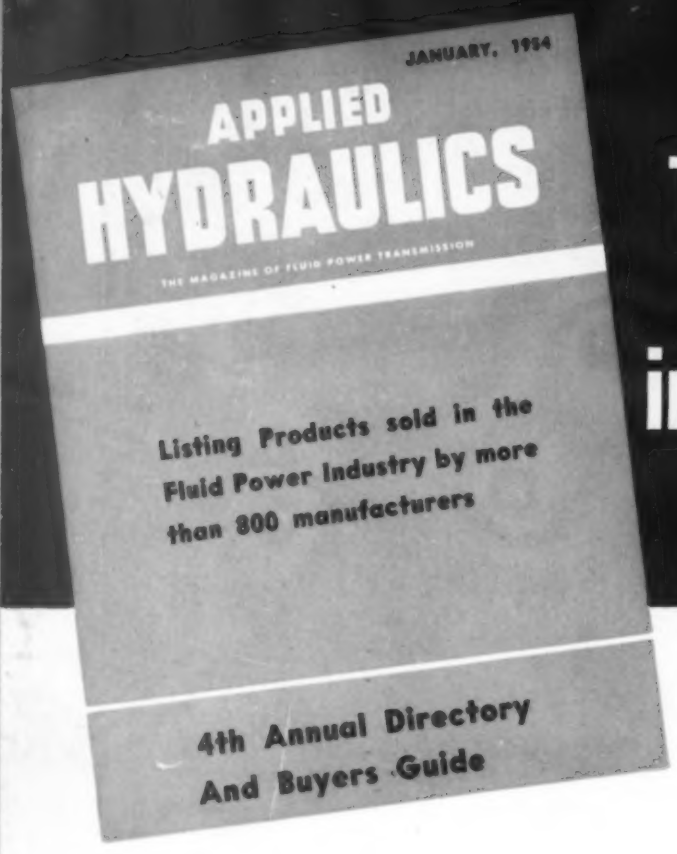
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The Only Buyers Guide in the Fluid Power Field

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2. DIRECTORY: Index of manufacturers and suppliers of components, products, materials and accessories used in Fluid Power circuits on all types of machinery and equipment. The address of each company, and products it manufactures are included.

3. Articles and regular departments, coordinated to the theme "Profit in Fluid Power," will enhance the year-round reference value of this Directory and Buyers Guide issue of APPLIED HYDRAULICS.

APPLIED HYDRAULICS

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